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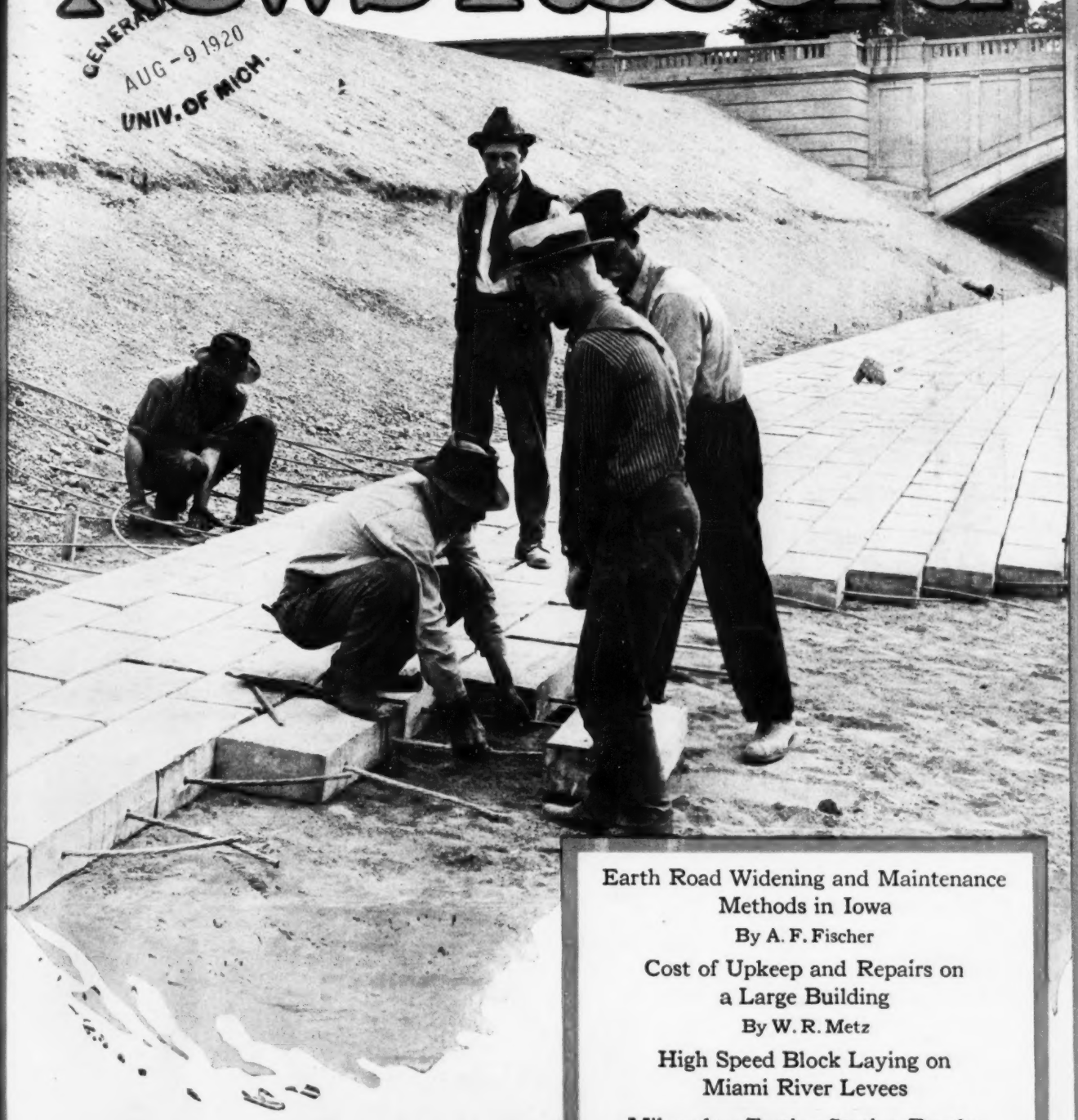


Laying Concrete Blocks, Miami River Channel Improvement

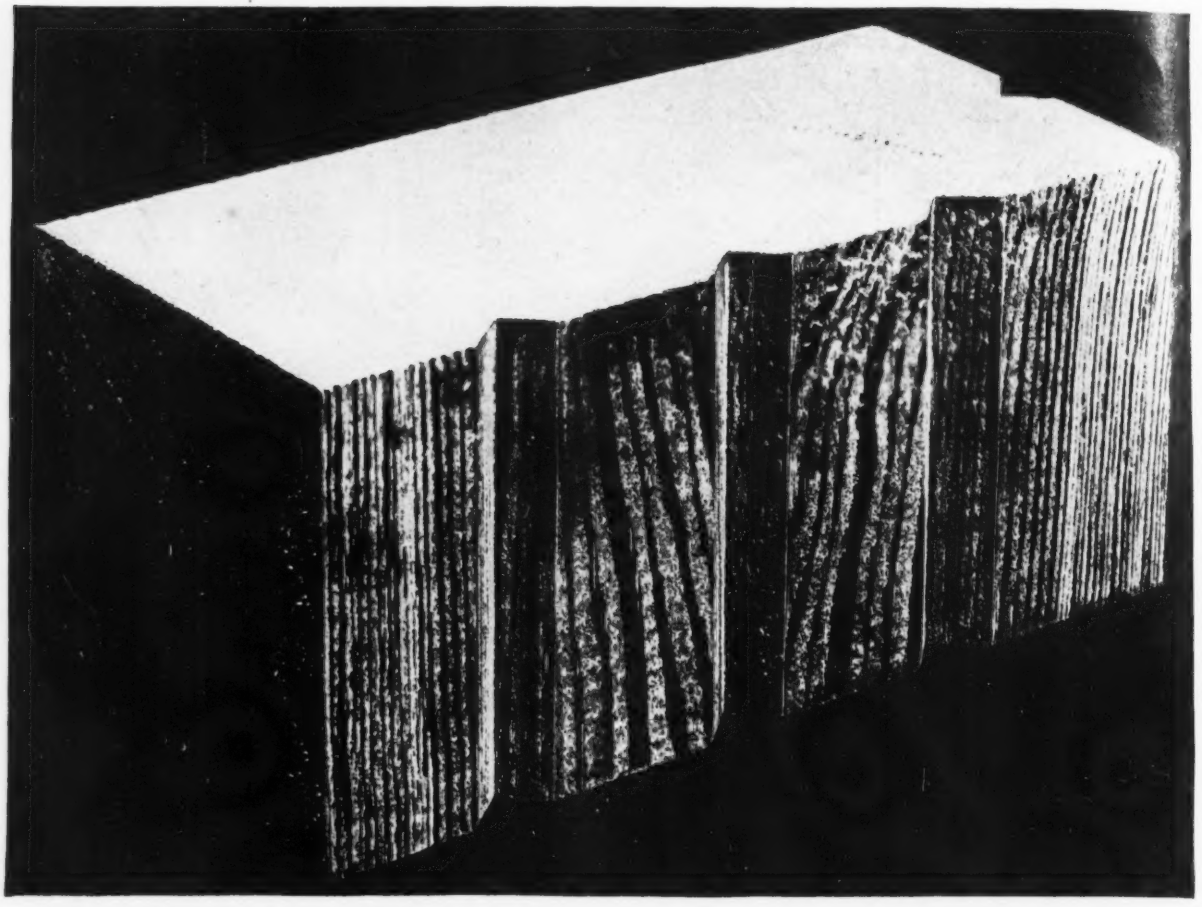
Earth Road Widening and Maintenance Methods in Iowa
By A. F. Fischer

Cost of Upkeep and Repairs on a Large Building
By W. R. Metz

High Speed Block Laying on Miami River Levees

Milwaukee Testing Station Results on Filtration of Water

KREOLITE WOOD BLOCK FLOORS



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The Westinghouse Air Brake Co.	14	81,270
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The National Enam. & Stamping Co.	12	196,848
The Timken-Detroit Axle Co.	12	67,086
The Du Pont de Nemours Powder Co.	11	26,109
The Standard Steel Tube Co.	11	36,207
The Lunkenheimer Company	10	65,710
The Olds Motor Company	10	376,180
The United States Aluminum Co.	10	220,510
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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. Mehren
Editor

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An Irrigation Triumph

EVEN after allowing for the picturesque hyperboles of Southern California, the story of recent shipments of canteloupes and less mouth-watering products from the Imperial Valley must be accepted as valid testimony to the triumph of irrigation. Other sections also bear witness to the marvels of irrigation but the appeal to the imagination made by the products of a once-dreaded desert far below sea level is perhaps the strongest of all. There if anywhere water is king and the engineers who bring the life-giving water to the dead or sleeping land perform little short of a miracle.

Lake Cities All Coming to Filtration

TIME was when any question as to the quality of the water supplied to a city from the Great Lakes was thought to be fully met by building a longer intake. Then chlorination came as a safeguard against typhoid. Rising standards demand filtration. Detroit and Milwaukee are now falling into line after Toronto, Cleveland and many smaller places in providing complete water purification plants. Chicago, among lake cities large and small, stands almost alone without filtration. Sooner or later she also will fall into line—perhaps sooner than she expects.

Water-Testing Stations Still Pay

SIMPLE as the lake-city water treatment problems seem when the relatively clear waters from their mammoth settling, aerating and bleaching reservoirs are compared with the turbid and stained waters of other sections, a number of lake cities have nevertheless found it prudent to build and operate testing stations before working out the details of their water-treatment plants. This has been done successively by Cleveland, Detroit and Milwaukee. Some of the leading features of the Milwaukee tests are given on p. 257. The data show anew how many problems there are to be studied in each water purification case and that notwithstanding the many advances in our knowledge of water treatment yet water testing stations still continue to pay their cost.

Ozonization Not Yet Practicable

WITH the relatively clear lake waters, if at all, ozonization as a bacterial finishing process might be expected to work well and cheaply. The Milwaukee tests mentioned above are most discouraging in this respect. After these and other trials, both working-scale and experimental, ozone seems farther than ever from being practicable, both as a matter of plant detail and of cost. All that it can do, it appears, can be done at least as well, and with far less trouble and expense, by chlorination. Yet ozonization continues to lure on the promoter and with his aid to charm the layman. Experienced water engineers are generally skeptical as to ozone treatment, as well they may be in the light of experience. Nevertheless it is well to have a mind sufficiently open to accord a test now and then to new ozone apparatus in the hopes that a practicable ozonization plant has at last been devised.

A Personal Contract

CONTRACTS for engineering construction work are in their form impersonal, but every such contract has most obviously a personal element, and we think it is well for the sound conduct of the business transacted between engineers and contractors that this element should not be suppressed or lost sight of. Explicit recognition of the personal relation, such as is found in the Miami Conservancy District levee protection contract, is strikingly novel, however. We recall no precedent. In view of the limitations affecting such a contract it has no doubt a rather peculiar status in law. Yet we think it is clear that the essential purpose of a contract, namely, to embody the meeting of the minds of the contracting parties, is most fully realized by the form of contract under consideration, through the very fact that it gives expression to the personal relation. The case is worth taking careful note of. To make its circumstances more clear to those who may want to consider its application elsewhere one point might be added to the information given in the article on p. 247 of this issue, namely, that because the same contractor had previously done work for the district there was a direct knowledge of personalities on both sides, and this established the basis for the personal relation expressed in the present contract.

The Neglected Gusset Plate

A DETAIL study of two truss joints presented on p. 259 directs attention to an element of structural and bridge practice that has remained in a state of unfortunate neglect, namely, the gusset plate. While we have talked and thought at great length and to good purpose about main members, loads, secondary stresses and a variety of similar engineering questions, the gusset plate has been allowed to remain on a purely empirical basis. In common practice joint plates are designed by the simple process of finding out how much space is required to accommodate the necessary rivet lines and then sketching in the smallest plate that will circumscribe these rivet groups. This is unscientific. It assumes quite confidently that the smallest possible plate will be strong enough to take care of all the tearing and shearing stresses set up in it by the pulls and pushes and twists which the several members connected exert. No attempt to compute or estimate these stresses has appeared in public discussion for a long

time past. Yet it is obvious that the same principles of designing for adequate strength that control truss or girder design, for example, are valid also for gusset plates. It does not appear logical to let these important detail elements go on faith, in the view that simply because we have had no particular trouble with them hitherto therefore we need not worry about them. The principle underlying modern designing is to approximate a quantitative estimation of the stresses throughout the structures we build, and be sure they are conservative and yet involve no large waste of material. Such analyses as that of Professor Wilson lead in the direction of a study of gusset-plate stresses, and when this is once fairly in hand the structural art will be measurably nearer perfection than it is today.

Earth Road Upkeep Made Part of Paving Construction Program

TRACTOR-GRADER and drag road work in Iowa is part of a permanent-road construction program. By working machine graders systematically to plan much widening and ditching and a material amount of longitudinal grading can be accomplished in the regular course of keeping up earth roads, thus creating a base for future permanent roads. By this notable results have been accomplished. Considering the five years previous to Jan. 1, 1919, when the paved main-traffic-route program now in progress in Iowa was inaugurated, the physical accomplishment had been as follows: With 105,000 miles of earth roads and an expenditure of less than $100 per mile, exclusive of permanent bridges and culverts, nearly 3,000 miles of road grade had been completed ready for hard surfacing, over 13,000 miles additional were completed partly to permanent grade and the entire mileage was kept in condition for traffic. In places requiring major longitudinal grade changes other construction operations than those described on p. 269 were required, but, speaking generally, the results enumerated were accomplished by tractor-grader and drag operations.

With the results described to its credit, the process may not be overlooked as a possibility elsewhere. Indeed, for the large-mileage agricultural states of the South and the West the plan has distinctive merit. It is essentially a process of building roads from the bottom up, and it is cumulative. In the first respect it is fundamentally sound road construction engineering, and in the second it is within the financial ability of any community. In the present craze to spread hard surfaces over great mileages of road the qualifications named require to be kept closely in mind.

With the best that a liberal public can do in financing "permanent" highway types not one mile in ten of the roads in the agricultural states of the South and West can be hard paved for many years. But meanwhile the roads should be fit to carry a growing traffic. To do this they must be built up and maintained. Perhaps $50, and possibly $100, a mile each year will be the average expenditure which is permitted. By the plan and the method described, experience in Iowa proves, approximately one-half of this annual expenditure can be made to contribute to permanent structure, and in time the accretions will have produced all that enters into a permanent paved road except the hard surfacing.

The Increase of Railroad Rates

WITH the end of the Government guarantee, Sept. 1, the railroads will find themselves on an independent basis of earning power with a new rate level that should insure the restoration of their credit sufficiently to bring about much needed development of the country's transportation system. The sums involved in the decision of the Interstate Commerce Commission to increase rates from 25 to 40 per cent are unprecedented in the history of railroad ratemaking under private operation. The lesson to the country that service cannot continue to be furnished at less than cost must be obvious. Certainly this is recognized by the Commission in assuming, in its calculations, that maximum rather than the minimum rate of return in view of current high rates of interest. It is significant that the decision not only embodies the routine carrying out of provisions of the Transportation Act, but also indicates a new spirit of liberality, and a recognition of the vital necessity of adequate railroad service, on the part of the governmental regulating body.

While the construction industry may be hard hit by such a sudden and large proportionate increase in the cost of hauling bulk materials—particularly those used in road building—engineers and contractors will be quick to realize that the effect may be such a development of transportation facilities that incalculable benefit to the industry will result. One item of the rate decision that remains unexplained is that refusing to grant a lower rate allowance on certain bulk materials as sand, gravel, and stone, while iron ore will be shipped at a rate lower than that indicated by the percentage increase. Probably of greatest immediate importance to constructors in railroad work is the likelihood of a tremendous volume of construction, long held in abeyance, being released through the re-establishment of railroad credit.

More than ever the public will realize the importance of the valuation of the railroads which has been so long under way. While the Transportation Act does not indicate what basis of "value" shall be used in establishing rates, it is accepted as practically certain that the results of the physical valuation, as fast as they become known for a large portion of mileage, will be used to determine "value" for rate-making purposes under the Act. In the present instance the Interstate Commerce Commission, following the mandate of the new law, has considered the "book value," or property investment account, only in the light of supporting evidence and not as conclusive. The sum designated as the temporary aggregate "value" by the Commission falls short by some 10 per cent of the aggregate "book value" which the railroads desired should be used. Since 1907, when uniform railroad accounting was established by law, the property investment accounts are accurate for purposes of comparison, but both the carriers and the Commission realize the frailties of these accounts previous to that time. As yet insufficient mileage of standard roads has been covered by the physical valuation to indicate definitely the relation between "book value" and the various bases of value called for by the Valuation Act. The need for rapid completion of the valuations is apparent.

Included in the estimates for the rate increases is allowance for the $600,000,000 wage grant of the Railway Labor Board, which was the cause of the railroads'

adding various items to their original proposals. Now that the carriers have been granted so nearly what was asked railroad credit should in large measure be restored and development go forward. Responsibility now rests with the railroad managements themselves to bring our transportation system up to that point of efficiency that the country requires and demands for its normal development. Considerable time will be required to bring all this about, but plans for such a large volume of work are already complete that the question of financing alone should stand in the way of an almost immediate beginning of actual construction.

Mounting Society Convention Expenses

THE expenditure of time, energy and money on engineering conventions has become so heavy as to raise serious question as to the justification not only of the expenditures but also of the conventions themselves. The burden, for such many feel it to be, has various causes. First, is the multiplicity of societies. For this there is an obvious though heroic remedy. Next there is the heavy expense that conventions entail. Part of this is within the control of society directors and of members who attend conventions but much of it is beyond society or personal control, since it is due to increased railroad and hotel charges and other elements in the present high cost of living.

No complete analysis of the situation just outlined has yet been attempted, nor can it be essayed here, but some light is thrown on the subject by a recent report made by a field secretary of a national society who analyzed the convention expenses of his organization six weeks after adjournment. He wanted (1) to get impressions for the guidance of the next convention; (2) to see to what extent the local organization had been stimulated and whether its energies had been increased by the contagious enthusiasm of outside delegates. He found the local had profited not at all. His cost analysis and accompanying comments would probably fit many other organizations. Summarized they are:

For an attendance of 150 at the convention there was spent about $1,600, of which 42 per cent went for banquet and lunches; *16 per cent for badges;* 12 per cent for decorations, music and flowers; 10 per cent for printing programs and for incidentals (no advance papers); 8 per cent for cigars, 7 per cent for booths and signs, 3 per cent for tips, and 2 per cent for typewriting. The banquet cost was largely borne by the delegates. This was not an organization of brakemen nor miners nor undertakers, but a regularly established engineering society, whose meeting was decidedly a success by all present-day standards.

The expenditure in question is only a small part of the real tax on the association. In addition, each delegate had his expenses paid by the local he represented. The secretary of the society estimates an average expense account of $100. So the $1,600 becomes $16,000. This all falls on the individual members, through their dues. In view of such a total for a single convention of only one of our many engineering societies, it is evident that engineers are paying large sums for society support.

The day before the field secretary's report came to our attention an interview was had with a veteran society joiner who supports thirty different organizations and says he has not been free from director's duties in some one of them for the last twenty years. After reading the report just mentioned he remarked:

"There are too many societies. Too much money is frittered away on inconsequental meetings. Nearly every organization I know is in financial difficulties. Money for new work cannot be diverted from existing activities and leave anything worth while. Many a society is being crucified on the printing press. Printing costs have tripled. I have helped solve society problems for thirty years and the new problems do not look any smaller than those of the past. Money is the problem now and a lot of societies ought to go out of existence and let their members lend support to the smaller number that would remain. This every engineer now sees or should see. Stern financial necessity may force the issue but if the number of engineering societies decreases through financial starvation, will it be the fittest societies that survive?"

These remarks will find wide acceptance. If they stress too much the financial burden on the societies, that is not surprising in view of the fact that finances are for the moment uppermost. But the demands which the multiplication of societies make upon the time and energy of the engineer must not be overlooked. These demands tend to a divided allegience and scattering of effort that often leads to paralysis.

Coming back to the financial burden entailed by engineering society conventions, the question that demands attention is what sort of expenditures are warranted and how can society funds best be apportioned between legitimate objects of expenditure? To answer the question is a task for the societies rather than for us. But a few questions may properly be raised for consideration: Is "42 per cent for banquet and lunches" and that with "the banquet cost largely borne by the delegates" (meaning the locals that sent them) reasonable? And how about "16 per cent for badges"? Are badges, other than a possible name slip in a penny frame, of any possible use at an engineering convention? The percentages that went for the remaining items will bear restating: Decorations, music and flowers, 12; printing and incidentals (no advance papers), 10; cigars, 8; booths and signs, 7; tips, 3; typewriting, 2 per cent. A liberal ruling would class as essentials only the printing and incidentals, booths and signs, the tips and the typewriting. These total 22 per cent or $352, compared with 12 per cent or $252 for badges. The item of 2 per cent for typewriting, on its face, indicates a small total output of convention results to be recorded, but perhaps the proceedings were recorded by a secretary or staff stenographer whose salary is not included in the expense summary.

We have commented on this percentage division of expense not so much to criticise any one item or group of items as to direct attention to the mounting burden of engineering society convention expense and to suggest that officials of other societies might well analyze their convention expenditures. But they should not stop with mere analyses. They should balance each item against the result it yields and see how many and which are found wanting. Then as each convention approaches, both the expense budget and the technical and business program should be framed with a view of obtaining the greatest good to the largest number from every dollar of society and personal expenditure at the convention.

Improvement Work on River Murray in South Australia

Longest River on Island Continent Now Being Regulated Mainly for Navigation by Locks and Dams

By Robert C. Cutting
Constructing Engineer, River Murray Works, Blanchetown, South Australia

River improvement work, comparable in many ways to that being carried out on the Ohio River, has been under way for some years on the River Murray in South Australia. In spite of setbacks due to the war construction has been regularly pursued and the first structures are reaching completion.

The River Murray with its tributary streams, the Darling and Murrumbidgee, forms the longest river system in Australia, having, under favorable conditions, a combined navigable length of 3,212 miles. The discharge varies with the seasons of the year, being least from February to July and greatest from August to January. During the periods of low water navigation is suspended, except on the lower 175 miles of the Murray. The slope, and therefore the current, of the river is very gentle. In the upper reaches a maximum of about 9 in. per mile is found, decreasing until at the lower end it is only 2½ in. per mile. A large area of inland country is served by these rivers and considerable traffic of wool and wheat is carried by steamers and barges plying the waters.

These streams have their headwaters in the coastal ranges of New South Wales, Victoria and Queensland. After leaving the highlands they pass through some of the most fertile regions of the continent. The rainfall over these areas is not generally sufficient for agriculture but with the aid of irrigation valuable crops of fruit, vines and cereals can be obtained The irrigation of these lands was started some years ago, but with the great development of the industry it has become necessary to adopt means for further conserving the water for both irrigation and navigation, so as to make possible the closer settlement of the river valleys.

In New South Wales the Burrinjuck Dam on the Murrumbidgee, storing 771,000 acre-feet, is nearing completion. From it water will be supplied to a large area, while in Victoria and South Australia there are many thriving settlements irrigated by water from the Murray or its tributaries.

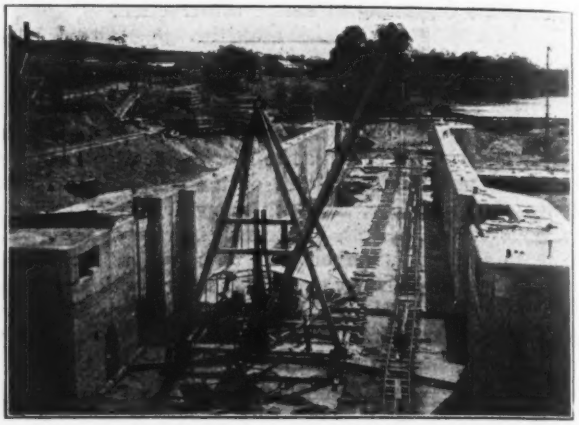


FIG. 3. FINISHING LOCK NO. 1 ON RIVER MURAY IMPROVEMENT, SOUTH AUSTRALIA

The projected works include 26 locks and dams on the Murray, 9 on the Murrumbidgee, development of a storage basin of 514,000 acre-feet capacity at Lake Victoria, a natural lake in New South Wales, near the South Australian border, and construction of a high dam across the Murray, near the Mitta Mitta, to form a storage reservoir of 1,000,000 acre-feet capacity.

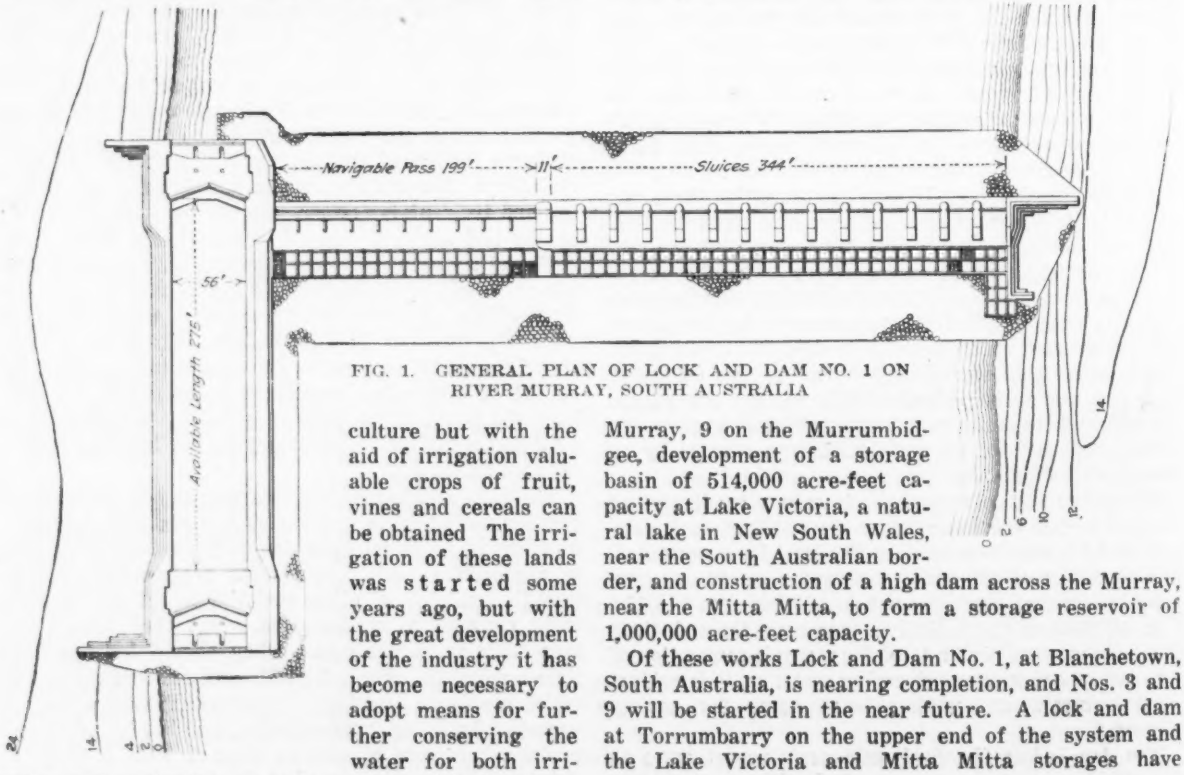


FIG. 1. GENERAL PLAN OF LOCK AND DAM NO. 1 ON RIVER MURRAY, SOUTH AUSTRALIA

Of these works Lock and Dam No. 1, at Blanchetown, South Australia, is nearing completion, and Nos. 3 and 9 will be started in the near future. A lock and dam at Torrumbarry on the upper end of the system and the Lake Victoria and Mitta Mitta storages have recently been started.

The general plan of Lock and Dam No. 1 is shown by Fig. 1. It is typical of the other dams to be con-

structed. The work comprises a lock, a navigable pass, fourteen sluices and an abutment. The lock is 378 ft. long over all. It has an available length of 275 ft. and a width between the walls of 56 ft. The walls are 24.5 ft. high above the lock floor and have a 5-ft. freeboard above the full upper pool. A concrete floor 3 ft. thick, reinforced with 1¼-in. twisted steel bars, extends over the area covered by the lock. Slots or keyways were left in this floor in the vicinity of the walls to provide

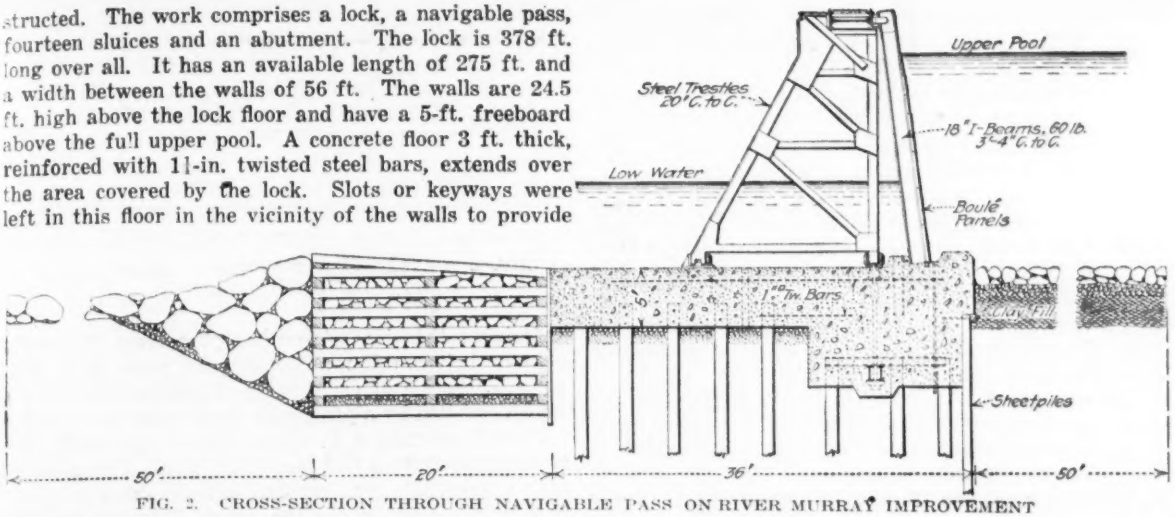


FIG. 2. CROSS-SECTION THROUGH NAVIGABLE PASS ON RIVER MURRAY IMPROVEMENT

a suitable bond and the walls were then built on the floor slab. In order to limit the upward pressure which might accumulate under the floor, due to springs or small leaks, a system of 12-in. drain pipes, surrounded by crushed stone, was laid and connected with the lower pool at the downstream end of the lock.

The lock walls are of concrete, built in monoliths 26 ft. long with vertical keys between the monoliths. The land wall is 16 ft. wide at the base and 5 ft. wide at the top with vertical face and stepped back. The river wall is 17 ft. wide at the base and 6 ft. wide at the top with vertical lock face and battered outer face. Both walls are widened at the upper and lower ends to provide for conduits and give sufficient mass to resist the thrust of the gates.

The lock is filled through conduits in each wall which take the water from the forebay above the upper gates and discharge it into the lock through five 3-ft. square openings in each wall. Each conduit has three openings at its upper end closed by 6 x 3-ft. butterfly valves which are opened and closed from the top of the walls by handwheels operating worm gears. Similar valves are provided at the lower end of the lock for emptying.

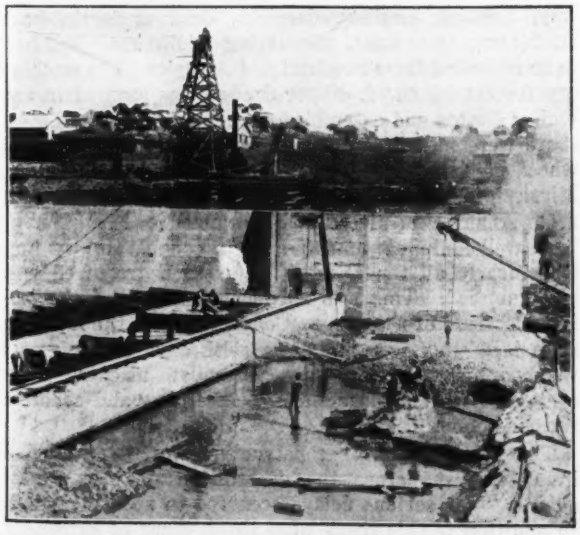


FIG. 4. PLACING CLAY BLANKET ABOVE NAVIGABLE PASS

The mitering lock gates are constructed of ironbark timber (*Eucalyptus leucoxylon*). They are horizontally fromed, the beams being placed clos together at the bottoms of the gates, but near the top they are separated by jarrah filler blocks. The openings caused by the fillers are closed on the water face by 2 in. California red pine sheathing, placed vertically and calked, while on the backs they are covered by 2-in. jarrah sheathing, laid diagonally with ¼-in. open joints. Heavy steel straps hold the timber courses together. The heels of the gates rest in cast-iron hollow quoins set in the concrete of the walls, the bottoms closing against 12-in. by 12-in. jarrah miter sills. The gates are operated by spars and wire lines by the aid of small hand capstans.

At each end of the lock, above the upper gates and below the lower gates, anchorages have been provided for two of the steel Boulé trestles from the navigable pass. By the use of these trestles and using the stop logs from the sluices as needles a cofferdam can be easily constructed, thus enabling the lock to be pumped out in case repairs are required. A sump is provided at the lower end for the pump suction.

Riprap has been placed at the upper and lower ends of the lock and along the outer face of the river wall to prevent undermining in case destructive currents are set up from any cause.

Both the upper and lower lock sills are placed at the same elevation (El. 99), which gives a minimum depth over them of 7.8 ft. when the river below the dam stands at low water stage (El. 106.8).

The navigable pass, that portion of the dam through which the traffic passes when the dam is down, the river being sufficiently high to permit open river navigation, has a width of 199 ft. and its sill, the highest projecting part when the dam is lowered, is at El. 101.0 or 5.8 ft. below low water. Fig. 2 is a cross-section of the navigable pass. Steel trestles, spaced 20 ft. c. to c., support steel plate girders 19 ft. 11½ in. long laid on their sides; 18-in. 60-lb. I-beams, having their upper ends resting against the upstream edges of these girders and lower ends resting in steel castings set in the concrete foundations and spaced 3 ft. 4 in. apart carry the Boulé panels, which are of the ordinary type. This is an unusual arrangement of a Boulé dam, which

generally has a separate trestle between each set of panels. In the present case, however, the aim was to eliminate as far as possible all submerged iron and steel work which could not be readily removed for painting, as the water of the River Murray, especially at low stages, is highly charged with mineral salts which have a very destructive action on iron and steel. The arrangement adopted substitutes for a large number of trestles of light section a comparatively few trestles of heavy section, thus greatly reducing the surface area subjected to the corrosive action of the water.

The sluices or section of the dam between the navigable pass and the abutment is composed of a series of concrete piers, each 6 ft. wide, on a concrete foundation slab. These piers are placed 25 ft. c. to c., leaving a waterway 19 ft. wide between each pair of piers. At the upstream end of each pier vertical slots are provided to hold the horizontal stop logs for closing the openings. The bottom course of logs are 12 x 12 in., while near the top 10 x 10-in. logs are used. Horizontal timber beams carrying a footway and rails for operating winches are provided. This arrangement was adopted in conformity with the policy used throughout the design of eliminating as far as possible all submerged metal work which would not be readily accessible for painting. The design, involving a number of narrow piers, was rendered possible by the fact that no ice and very little drift is found in the Murray. The native timber, mostly of the Eucalyptus family, is of too high specific gravity to float, except when absolutely dry.

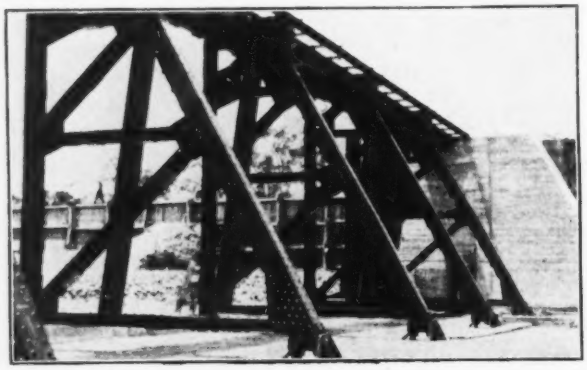


FIG. 5. CLOSE VIEW OF NAVIGABLE PASS TRESTLES

The abutment is of the ordinary shape used in similar construction, consisting of a retaining wall with wing walls reaching back into the bank.

With the exception of the land and breast walls of the lock, which are founded on rock, all foundations are provided by timber piles of Australian stringy bark (*Eucalyptus obliqua*). The piles varied in length from 12 ft. near the land wall of the lock to 30 ft. near the location of the sluices. A continuous line of timber sheetpiles was driven along the outer face of the river wall, being carefully sealed into the upper and lower breast walls. A similar line of sheetpiles was driven along the upper face of the navigable pass and sluices and along the outer faces of the abutment walls. These sheetpiles are of a special type as shown in Fig. 6. They were very carefully driven in order to maintain a perfect interlock and good alignment. A water jet was freely used and the piles were driven to the rock underlying the site. After the piles were driven the grooves between the adjacent ones were filled with grout, composed of equal parts of portland cement and sand, deposited by a pneumatic grout mixer and ejector.

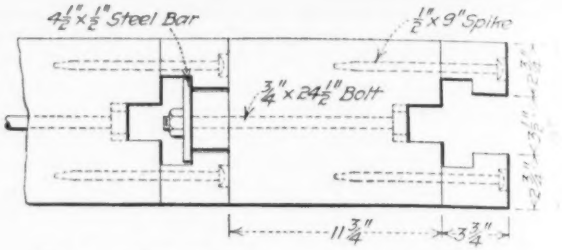


FIG. 6. CROSS-SECTION OF WOOD SHEETPILE AT NAVIGABLE PASS

For all concrete a 1:2½:5 mixture was used. The cement was from a mill located in South Australia, the coarse aggregate was crushed granite from a quarry developed especially for the work, 70 miles by river below the lock site, and the sand was obtained from the river near the work. Where reinforcement was required in the concrete it was supplied in the form of square twisted bars.

All permanent timber work except the lock gates and bearing piles was constructed from jarrah grown in Western Australia. This is an excellent hardwood and is readily obtained in large sizes. For forms and other temporary work Oregon fir from the Pacific Coast of the United States was used. There is comparatively little softwood native to Australia and Oregon fir is largely used where light construction is required.

The steel and iron work was fabricated in the state. Some of the structural shapes were rolled at the new steel works at Newcastle, N. S. W., but most of the material had to be imported, some from the United States and some from England. Prevailing war conditions made the procuring of this material very difficult, both on account of the scarcity of shipping and the shortage of material available for civil work.

Before any work was possible a construction plant had to be accumulated. Some of the items required, such as boilers, narrow-gage cars and barges, could be constructed locally but the major items, including cableway, hoisting engines, derricks, dredge, derrick-boat machinery, steamboat, piledriving equipment, etc., had to be imported from England and America. The machinery for the 1½ cu.yd. dipper dredge was secured in the United States and assembled on a locally built hull. As there were no suitable steamboats on the river a stern wheel, steel hull steamer, similar to those used on the Mississippi and tributaries, was secured. This was sent from America in pieces and assembled on the river.

A well-equipped machine shop capable of dealing with nearly all repair work likely to be required was also supplied. This was necessary because of the isolated location of the work. Connected with the machine shop is a wood-working shop, with sawmill, universal woodworker and band saw, where all machine work connected with manufacture of sheetpiles and concrete forms is done.

The preparation for construction work was started in 1914, just before the declaration of war, consequently some serious delays occurred in securing plant. In addition to this there were three years of extremely high water in the river, during much of which time no

work was possible; also the labor and material shortage, due to the war, has greatly hindered progress.

In 1912 Col. E. N. Johnston, Corps of Engineers, U. S. Army, was engaged by the South Australian government, as consulting engineer, to report and furnish plans for the improvement of the river between the mouth and Wentworth, N. S. W., and in 1914 the writer was engaged as constructing engineer to supervise the construction work. It is expected that Lock and Dam No. 1 will be completed this year.

Specified Manager Made Essence of Contract

Unusual Clause Calls for Personal Services of Contracting Company's President on Miami Work

POWER to terminate the agreement at once upon the disability of a specified individual to direct construction is a unique feature of the contract for levee revetment at Dayton, O., which the Miami Conservancy District has with Price Bros., general contractors. A form of cost-plus contract was written which, besides providing definitely that the president of the contracting firm must personally direct the work, contains a number of stipulations which are not usual. Perhaps the most uncommon of these is that the contractor's fees are based on estimated unit costs of the principal items.

The work to be performed is 10,000 cu.yd. of monolithic slab revetment concreted in place and the placing of a flexible mattress of precast concrete blocks strung on a steel cable. The blocks are 24 x 12 x 5 in., and 175,000 are required in the mattress. Construction cost is defined so as to include all items entering into the expense of the work except the contractor's salary, his personal charges, and his central Dayton office charges,, and except the cost (f.o.b. cars or in storage) at Dayton of cement, reinforcing steel, expansion-joint material, wire rope, sand and gravel, which are furnished by the Conservancy District. The allowable costs are to be determined from the contractor's vouchers and pay rolls by the district's auditors.

By agreement, the estimated costs, based on the wage scales prevailing at the date of the contract, are established as: $1 a cubic yard for excavation, $8.25 a cubic yard for monolithic slab revetment and 15½c. a block for laying flexible-slab mattress. At the date of the contract the wage rate paid by the District for common labor was $5.06 a ten-hour day. Should this rate increase or decrease the estimated costs are to be increased or decreased in the same ratio. The contractor's fees are based on the estimated costs as follows:

At the end of each month a determination will be made of the total actual quantities of each item of work mentioned in this schedule completed to the end of such month. The sums of the amounts obtained by multiplying each such quantity by the corresponding unit price as named in the schedule will be termed the base price. Should the actual construction cost up to the end of each month be equal to the base price, the contractor's fee shall be 9 per cent of the base price. Should the actual construction cost exceed the base price, the contractor's fee shall be reduced by 25 per cent of the excess cost up to an excess of 10 per cent of said base price and by 50 per cent of all additional excess cost above 10 per cent of said base price, provided, however, that the contractor's fee shall not be reduced to less than 3 per cent of said base price. Should the actual construction cost be less than the said base price, the contractor's fee shall be increased by 25 per cent of the saving in cost below the base price up to a saving of 10 per cent of said base price and by 50 per cent of all additional saving above 10 per cent of said base price.

It is provided that required materials and supplies shall be approved by the District and furnished by the District at a charge into construction cost of actual cost plus 15 per cent. Equipment whether provided by the district or by the contractor is charged into construction cost at 2 per cent per month on the agreed value of the quipment. This charge begins when the equipment is put on the job and continues while the equipment is held on the job. Until a reserve of $2,500 is reached the contractor receives only 50 per cent of each month's fee and on completion of the work full payment, including the reserved amount, is made.

It is the essence of this agreement that the work provided for herein shall be carried on with the greatest efficiency and economy. To this end it is understood that the president of the company shall devote his attention to the work in all its details to obtain an efficient organization, a control over materials and supplies and the reduction of all waste. . . . This agreement may be terminated at once by the District upon disability of the present president of the company.

Cut-and-Dried Conduct of Society Elections

Incisive comment is passed in a recent issue of the *Engineering and Mining Journal* (July 3, 1920, p. 3) on the custom prevalent in engineering societies of establishing official nomination lists containing the name of a single candidate for each place to be filled. Contesting nominations from within the body of the membership are rare, and in substance the custom amounts to election of the officers by a nominating committee. We reprint the editorial without abridgment:

We have before us a ballot from the Harvard Engineering Society, to vote for officers. There is to be elected a president, a first and second vice-president, a secretary, a treasurer, and five governors. In the case of all but the governors, we are instructed to "vote for one." There is in each instance only one to vote for. In voting for the board of governors we are instructed to "vote for five." Only five candidates are given. We can go through the formality of voting the excellent ticket, which has been carefully selected by someone for us, or of throwing the documents in the wastebasket. In the interests of efficiency we shall do the latter.

According to the way of looking at it, this sending out of ballots, with no choice of candidates, to free and independent Americans, to ascertain their choice, is a meaningless courtesy of the Spanish type, a piece of stupidity, or an impertinence. What a waste of costly paper, perfectly good stamps, and clerical work there is here!

Engineers should stand for efficiency. If they get a Department of Public Works they are going to show the folks what efficiency is. Also, they should stand for honesty. Cut out, then, such meaningless ballots. If the form of your society (we are speaking to all engineers) is oligarchic—if a small group selects the officers and decides what the society shall do—simply advise those of us who are too busy to indulge in false motions who the officers are to be, and do not insult our intelligence as engineers and Yankees by asking which is our choice of one.

We do not intend to critize the oligarchic system as practiced by preference by engineers and scientists—although we should like each society some day to experiment with democracy. We are speaking now only from the standpoint of conservation of energy, and of efficiency. In the organizations in which we hold membership, we hereby appoint the secretary of each society which follows this system to cast our vote by proxy for all the candidates who will be appointed (elected) anyhow; and this proxy is permanent.

High-Speed Block-Laying on Miami River Levees

Trained Crew Weaves Concrete Mattress Blocks on Steel Cables at Rate of One a Minute—Only Hand Tools Employed

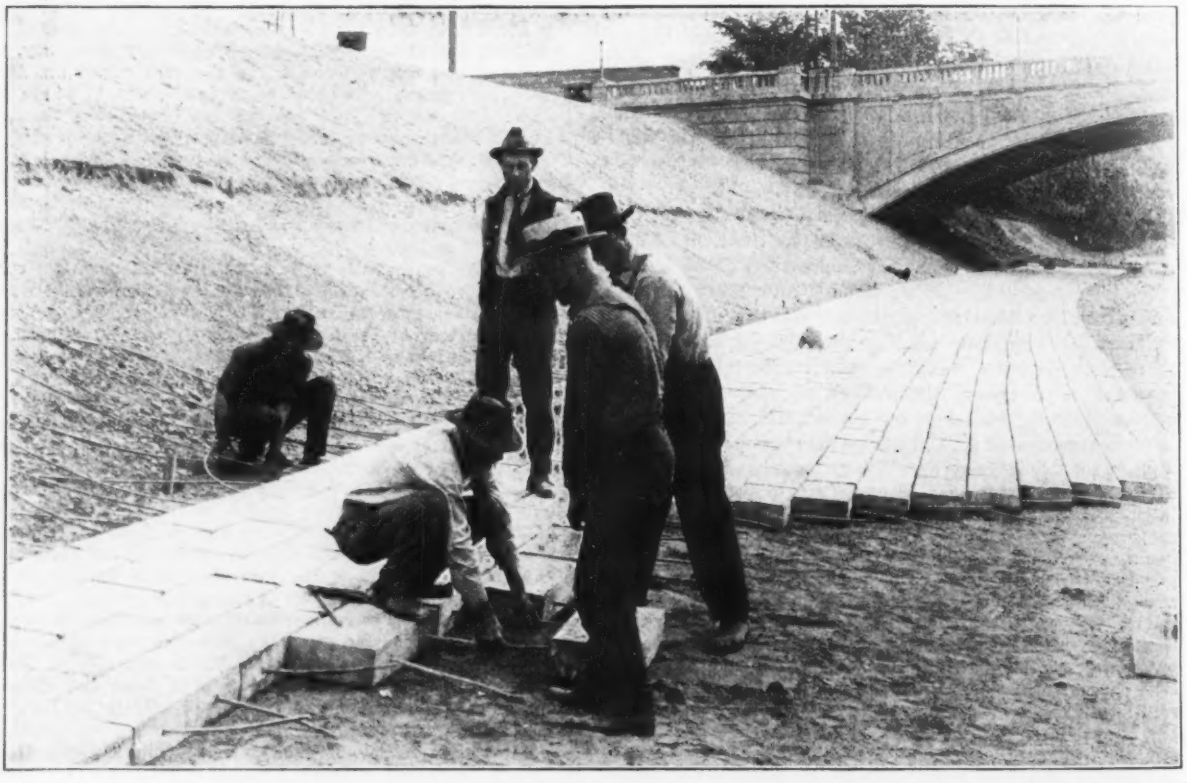
FLEXIBLE concrete mattress construction by stringing precast concrete blocks on steel cable, as beads are strung on a thread, is being done at remarkable speed in improving the channel of the Miami River at Dayton, Ohio. Four men carry and string, as a daily stint, 500 blocks, and they have placed as many as 800 blocks in ten hours Normally the stint is completed in eight hours. The area of mattress formed by 500 blocks is 1,000 sq.ft., each block being 24 x 12 x 5 in. and weighing about 118 lb. The ingenuity of the contractor in devising methods, his personal direction of the work and a skilled crew of old employees are the agencies chiefly responsible for this exceptional success of operations.

As indicated by the view, the task was to weave a 20-ft. ribbon of cast blocks on steel cable and after weaving to fasten the inner edge of the ribbon to the toe-wall of the slope paving and to hem its outer edge with heavy anchor blocks. The procedure adopted was: (1) With a special crew working well in advance of the revetment crews, to drive the sheet and foundation piles; (2) to string the blocks with the cable ends left projecting, and (3) to mold in place the slope slabs and to pour the toe-wall, cut-off walls and anchor blocks so as to embed the projecting cables and bind the blocks together.

As explained in *Engineering News-Record* of Aug. 21, 1919, p. 356, the blocks were molded and stored in a central yard. Block distribution by wagons, with a special body, was found to be most economical owing to the scattered locations of the placing operations, the steep descents from the levee tops to the beach and the rough and soft roads. A wagon to haul a load of 70 blocks, about 5,900 lb., was devised. It has a flat bed hung between and below the axles by means of goose-necks so that loading and unloading requires the least lifting of the blocks. The blocks are distributed along the work in the numbers required, so as to keep short the distance they must be carried in placing; in practice this distance averages perhaps 20 ft.

Wire rope on reels is hauled to a point on the levee top, central to the operation in progress. Here the reel is suspended on an axle and the rope, as required, is unwound between three pulleys staggered so as to remove the kink due to reeling. The straightened rope is cut into lengths twice the width of the mattress and enough longer to provide a loop for anchorage to the toe wall and "pig tails" at the free ends for anchorage to the edging blocks. Since the cut ends of the rope have to be threaded through holes in the blocks, a method of cutting which would prevent the wires from "brooming out" was essential. A torch was successful but the operation was too slow. A quick method was then found to be the provision of opposite semi-circular notches in the blades of an ordinary hand shear. The radial squeeze due to the notches, bends in and clinches the wire ends at the cut and forms an excellent rope end for insertion into the holes in the blocks.

With a form plank set to line and grade to mark the



FOUR MEN STRING REVETMENT BLOCKS ON CABLES FOR MIAMI CHANNEL IMPROVEMENT

inner edge of the mattress, block-laying is begun. The lengths of wire rope are folded to U-shape, like a wire hairpin. A rope is laid perpendicular to the mattress with the loop end up the slope and the free ends resting on the form plank. Two men with long-handled tongs, which permit them to grasp and carry a block without stooping, fetch a block from the pile and swing it sidewise toward the form plank, where a third man inserts the rope ends into the holes and adjusts the block to position. Then a fourth man standing behind the block layer pushes the two strands of rope through the holes and about a foot beyond. A second block is brought and threaded onto the rope and so on. As the blocks are laid to break joints across the mattress, several sets of rope are in process of being threaded and the blocks have to be laid in a prescribed order, the working face taking a diagonal direction across the width of the mattress.

With practice the block-laying has become almost machine-like in regularity and also astonishingly rapid, as is indicated by the fact that the daily stint of 500 blocks in eight hours is a rate of over 60 blocks an hour. This fast work is due first to the fact that the men are skilled old employees and second, o the arrangement in force by which the daily stint is a day's work, however quickly it is completed. Frequently the block-laying crew completes its six days' stint in five days and can either lay off on Saturday or continue work and draw seven days' pay for a six-day week. Another factor in the progress being attained is the personal direction of the work by a contractor ingenious in devising methods and in maintaining close relations with his workmen.

About 175,000 blocks and 10,000 cu.yd. of molded-in-place slab and wall concrete are included in the revetment and mattress work at Dayton. The contractor is Price Bros., Lansing, Mich. The operation is a part of the flood-protection work of the Miami Conservancy District, Arthur E. Morgan, chief engineer, Charles H. Paul, assistant chief engineer, and C. H. Locher, construction manager. J. H. Kimball has general charge of channel improvements and C. A. Bock is the division engineer on the Dayton channel work.

Alaska Railroad Costs

The average cost per mile of several sections of the Government Alaskan Railroad is indicated in figures recently submitted by Colonel Frederick Mears, chairman of the Alaskan Engineering Commission. The estimated average costs per mile for completed railroad vary from $43,000 as shown below.

AVERAGE COSTS PER MILE OF ALASKA RAILROAD

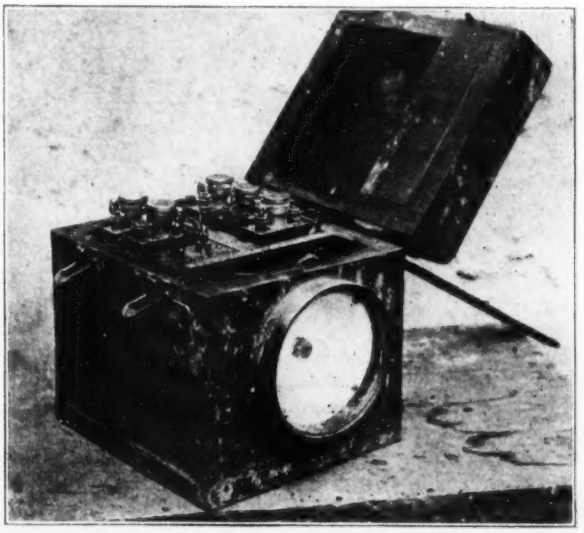
Section	Cost per Mile to Dec. 31, 1919	Estimated Average Cost per Mile to Complete	Estimated Average Cost per Mile Upon Completion
Mile 1 to mile 70.7, Seward to Kern Creek (70.7 miles)	$59,457	$13,120	$72,577
Mile 70.7 to mile 114.3, Kern Creek to Anchorage (43.6 miles)	112,865	6,500	119,365
Mile 114.3 to mile 150.9, Anchorage to Matanuska Junction (36.6 miles)	44,400	365	44,765
Matanuska branch (37.7 miles)	60,506	878	61,384
Mile 150.9 to mile 203.3, Matanuska Junction to Sheep Creek (52.4 miles)	46,256	2,700	48,956
Mile 203.3 to mile 264.1, Sheep Creek to Susitna River Crossing (60.8 miles)	42,700	23,100	65,800
Mile 264.1 to mile 290, crossing of Susitna River to Honolulu Creek (25.9 miles)	(1)	120,000	120,000
Mile 264.1 to mile 290, crossing of Susitna River to Honolulu Creek (25.9 miles)	(2)	70,820	70,820
Mile 290 to mile 315, Honolulu Creek to Summit of Broad Pass (25 miles)	.....	56,640	56,640
Mile 315 to mile 334.6, summit of Broad Pass to Carlo Creek (19.6 miles)	.....	63,275	63,275
Mile 334.6 to mile 347.3, Carlo Creek to Riley Creek (12.7 miles)	.....	70,000	70,000
Mile 347.3 to mile 358.2, Riley Creek to foot of Nenana Canyon (10.9 miles)	.....	157,080	157,080
Mile 358.2 to mile 411.2, foot of Nenana Canyon to Nenana (53 miles)	[3]67,560	6,825	74,385
Mile 411.86 to mile 467.7, north bank Tanana River to Fairbanks (55.8 miles)	30,700	13,000	43,700

[1] Includes 2 steel bridges. [2] Not including bridges. [3] Cost per mile includes Nenana River bridge.

Storage Battery for Sewer Work

TO BUILD a storage battery light that could be conveniently carried in one hand and which would provide adequate illumination for men engaged in repair or construction work in sewers, which could stand rough usage and which would require only simple and inexpensive maintenance, was the request made of the city engineer's office at San Francisco some time ago. The urgent need for such a light had become apparent after there were several accidents in the sewers due to the presence of explosive gases such as illuminating gas, gasoline vapor, etc. After designing several types and trying them out in actual service the city has adopted a light which satisfactorily meets all requirements for work in the sewers.

As first built the light consisted of a small wooden

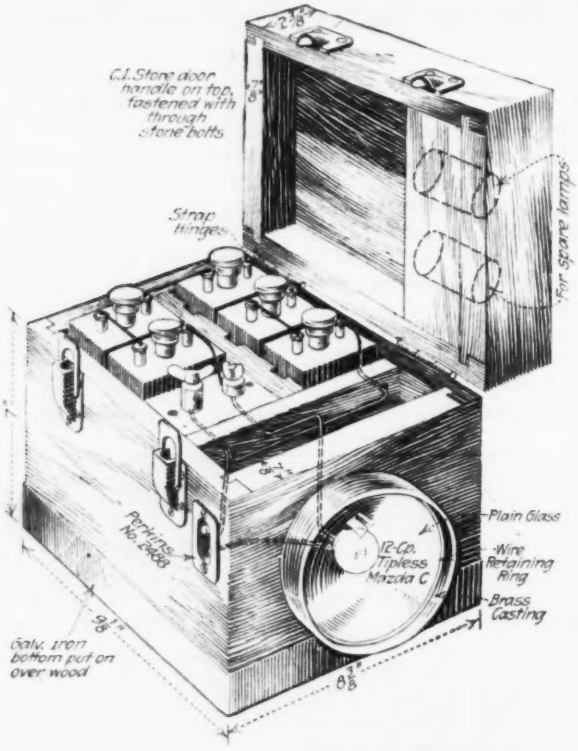


PORTABLE STORAGE BATTERY LIGHT USED FOR SEWER WORK IN SAN FRANCISCO, CAL.

box containing five storage cells with a 12-c.p. lamp in a silvered reflector fastened to the handle of the box. The cells were the Edison storage battery M-20, 12-ampere hour, motor-cycle type with rubber insulation. This arrangement was but partly satisfactory and later the lamp proper was attached to the box itself with a spun metal reflector coated with white enamel. This reflector gave a wider angle to the beam of light and did away with the "spottiness" and glare which was an objection in the earlier type using silvered reflectors.

After about a year's service of 12 of these lights it was found that the rubber insulated cell was likely to give trouble. The boxes were sometimes tipped over and filled with sewage and unless they were properly washed out and dried after such an accident, electrolysis made holes in the metal cell containers.

Accordingly, 24 lights having the same type of cells were built, but without soft rubber insulation. Hard rubber buttons attached to the cells were used to hold the latter in grooves cut in the sides and parti-


C.I. Store door handle on top, fastened with through stove bolts
Strap hinges
Stove bolts
Plain Glass
Wire Retaining Ring
Brass Casting
Perkins No. 2668
12-Cp. Tipless Mazda C
Galv. iron bottom put on over wood

DETAILS OF SAN FRANCISCO SEWER LIGHT

tions of the box. These lights were provided with an automobile type of push-button switch mounted so as to be operated from the outside of the box. The same enameled reflector was used as in the previous design. In place of a plug and jack, as used in the first designs, new terminals in the form of binding posts of dissimilar character, which will fit only corresponding wire terminals, are used in charging. The dissimilarity of the terminals on the charging cord insures proper polarity. Lights of this design, as shown in the accompanying illustration, have been in service for some time and are reported to be entirely satisfactory.

SET WEIGHS 18 LB.

The power of the light they give is quite sufficient to work by and yet does not consume a large amount of current. In fact, the lights are ordinarily used for three days' work without recharging. The set complete weighs 18 lb., which is considered rather heavy but it was thought worth while to make the box out of full 1-in. material and to reinforce it as much as possible so it would stand a great deal of abuse.

The recharging of the cells is done in the storeroom of the Board of Public Works. At first small motor generator sets were used for this purpose but it was later found more desirable to connect the cells directly to the direct-current circuit, using resistance units and a rheostat so that a varying number of cells could be connected in series and the current regulated to a strength of 2½ amp. With this arrangement the recharging of the cells is very simple and requires no expert attention.

Fire on Williamsburg Bridge

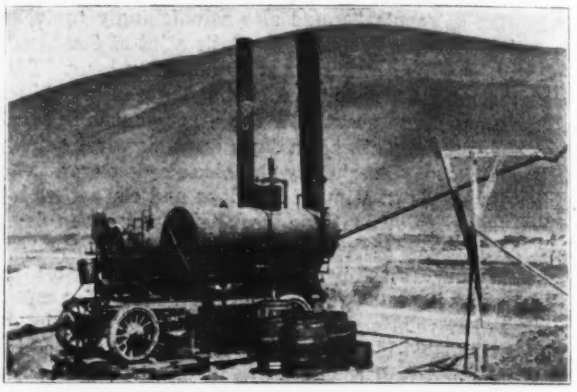
The Williamsburg Bridge over the East River, New York City, was damaged by the burning of a portion of the floor woodwork July 29.

Semi-Portable Oil Heating Plant for Surfacing Roads

Inexpensive Scheme Devised in California Reduces Delay and Cost in Heating and Delivering Oil

THE California Highway Commission has made a decided improvement in the means of unloading oil for surfacing roads. At first the practice was to install an oil heating plant at the railroad siding nearest the center of the stretch of road to be paved. The plant consisted of a steam boiler mounted in a brick setting, the necessary steam and oil piping systems and pumps for heating the oil and pumping it out of tank cars and a storage tank usually consisting of a pit lined with concrete.

Oil used for road surfacing in California always



CALIFORNIA HIGHWAY COMMISSION DEVISES NOVEL ROAD OIL HEATING PLANT

requires heating before it can be pumped from tank car or storage pit, but for installation such as described above, the cost is well over $1,000, exclusive of the equipment installed. If adequate time was allowed for the cement to set, it could hardly be built and made ready for service in less than a month or six weeks. As a result these plants were only put in at points from which a considerable mileage of work could be served, which meant long hauls for hot oil and perhaps superheating.

Where short stretches of surfacing or repair oiling had to be done some more flexible scheme was desirable. A semi-portable outfit built to suit this need has become standard. It is a self-contained unit that can be moved from place to place by motor truck at 10 miles per hour on good roads and which can be actually pumping oil within two hours after arrival at its destination. With it each tank car is now heated on the siding nearest the particular stretch of road which it is to supply and the oil is delivered at any temperature desired. By paying demurrage on a tank car for a day or two the necessity for constructing the storage pits is eliminated in most cases. Where storage pits are already in service, this outfit is used to heat the oil for delivery from the pit and when finished at one pit can be quickly moved. The term "semi-portable" is used to distinguish this plant from the portable oil patching outfit which carries its own supply of oil and is used only for very small patching jobs.

The outfit consists essentially of a steam boiler and

a retort, both mounted on the same automobile trailer chassis. All the necessary pumps and connections are grouped conveniently on the same frame, the arrangement being so balanced that there is less than 100 lb. difference in the weight carried by the two sides of the chassis. The outfit was assembled largely from parts of old equipment which were found in the Commission's store yards.

The steam boiler is of the marine type and is rated at 20 hp. It is 4 ft. in diameter and 9½ ft. long with a removable stack 10 ft. high. The retort was made from an old boiler shell ⅝ in. thick, 3 ft. in diameter, and 10 ft. long. From this the steam dome was removed and the opening covered with boiler plate. The stack opening was increased from 8 in. to 12 in. and two horizontal slots were cut in each head of the boiler shell to permit the upper and lower tiers of coil pipes to project through so that the connections between the coil pipes could be made outside the shell. To support the coils further 1-in. angle irons are bolted to the heads along the lower edge of each slot.

Upper and lower pipes of the coil are connected at the rear by bolted flanges and at the front by unions, thus permitting any single pipe to be removed independently. The retort is insulated by a 1-in. layer of asbestos covered by a 16-gage galvanized iron jacket held in place by ¼ x 1-in. iron strap. This jacket projects far enough to the rear so that the connecting flanges on the back of the retort may be inclosed in a false or extension head.

The invert of the retort is lined with firebrick and the burner deflects the flame downward against the brick to prevent burning the coils. Boiler and retort are attached by riveted connections to I-beams bolted across the frame of the chassis, and both have 10-ft. removable stacks.

The road oil is handled by a 6 x 4 x 6-in. steam jacketed pump mounted on a low bracketed platform hung at the front end of the plant. When the plant is set up ready for operation a 4-in. road-oil suction pipe with flexible connections is attached to the pump intake and connected with the discharge valve of the car. This suction line contains a 1-in. steam line with flexible connections for preventing the line from "freezing up" during any stoppage of the pumping. There is also a 1-in. steam line attached directly to the heating coils of the tank car. Under the arrangement used positive circulation of steam through the heating coils of the car does not depend upon the pump exhaust but is forced by a ¼-in. jet of live steam, thus eliminating back pressure on the pump.

In this manner the oil in the tank car is quickly raised to a temperature at which the pump will handle it and when the oil begins to circulate through the pump and the retort it is for awhile returned to the tank car so that operations can be hastened by using the heated oil to warm up the remainder of the oil in the car. When the desired temperature has been reached, usually 250 to 300 deg. F., a three-way cock on the delivery line turns the heated oil into the loading spout.

The fuel-oil system consists of a 3 x 2 x 4-in. steam pump mounted at the rear end of the plant, and provided with a pressure regulator, a heating reservoir and a return overflow as a release for the pressure regulator. This pump takes fuel oil either from drums or from a tank wagon connected to the pump supply line and delivers it at the desired pressure to burners in the retort as well as in the steam boiler. The rate of fuel consumption averages about 8 to 10 per cent of the volume of road oil handled, this ratio varying with the rate of sending out loads. The retort burner operates at full heat only during the actual loading of a tank. Also the fuel efficiency depends, of course, upon whether the oil is handled directly out of the car or heated only for unloading and then re-heated for distribution.

The weight of the outfit complete, exclusive of fuel and water, is 7¾ tons. Although it has to be handled with care, it withstands the jar of moving very successfully. When the plant is being moved the two smokestacks and the long sections of pipe for making connections to the car are carried betwen boiler and retort. When set up for service the chassis is jacked up and set on solid underpinning to avoid vibration.

Model Chimney Ordinance Specifies Flue-Lining for All Chimneys

All chimneys, irrespective of what material (brick, concrete, stone or hollow tile) must be lined with fire clay flue-lining or with fire brick, according to a model ordinance for chimney construction just drafted and issued by the Natioal Board of Fire Underwriters' committee on construction of buildings. The ordinance refers to chimneys of ordinary dwelling houses or the like and does not cover power plant chimneys or others in which high temperatures are maintained. Safe design and construction methods are described quite fully.

Brick or concrete chimney walls must be at least 4 in. thick, and concrete chimneys cast in place or concrete blocks must be reinforced in both directions. Stone chimneys must be 4 in. thicker, and rubble walls not less than 12 in. thick. Hollow tiles may be used for chimney walls where the chimney is attached to or forms a part of an exterior hollow tile wall of a building not over three stories high, in which case the chimney wall must be 8 in. thick or more. Flue-lining is specified to be not less than ¾ in. thick, to have no collars, to be set in cement-lime mortar 4:1 by weight (as used for the chimney wall masonry) and to be carried up continuously to 4 in. above the capping; the projection allows for a 2 in. sloping wash of rich cement-mortar and a 2 in. projection of the lining. When two flues are set in the same space within the chimney brickwork the in-joints must be offset at least 7 in.

Chimneys are to be built at least 3 ft. above flat roofs and 2 ft. above the ridges of peak roofs, and must be properly capped with terra cotta, stone, cast-iron or the like. Minimum flue areas are fixed as 75 sq.in. for furnaces or fireplaces, 49 sq.in. for stoves or ranges, and 10 sq.in. for small gas stoves or heaters. Where a flue enters the chimney in a cellar or basement, a clean-out must be provided below the smoke intake.

It is stated in support of this ordinance that the average annual loss due to defective chimneys in the United States, determined from three-year figures, was over $12,000,000, and taking account of unreported losses it is estimated that the total per year is over $16,000,000. All such fires are considered "strictly preventable." Ira H. Woolson, consulting engineer to the National Board of Fire Underwriters, drafted the ordinance, for a committee of the board headed by E. T. Cairns.

Old Wood Stave Pipe Successfully Rewound On the Job

By M. R. KIRKPATRICK
Superintendent, Ochoco Dam, Prineville, Oregon

THE wood-stave pipe now in use on the Ochoco hydraulic-fill dam near Prineville, Ore., was purchased a dozen years ago and since that time has been in use on 11 extensive sluicing jobs and has been many times moved, stored or shipped by rail. That it was worth shipping to the Ochoco work at all is much to its credit. After a short time in the hot, dry climate of Prineville, the winding became so loose from shrinkage of the staves that great care in handling was necessary to prevent the pipe from falling to pieces, and its use in a pipe-line without some repair was impossible. Submersion in water was tried in the hope that the wood staves would swell to their original size and so make the wire wrapping taut. This plan failed even when a pipe was left in the water until it became water logged. The next scheme tried was that of driving wooden wedges under each turn of wire until the wrapping became taut enough to hold the staves in place. Thus succeeded in making the pipes water tight, but the wedges made sharp kinks which caused the wire to break easily. Moreover, they interfered with rolling the pipe and gave it a very shabby appearance. It was then determined to attempt rewinding. After some experiment a method was devoloped which has been applied to several thousand feet of 14- and 18-in. pipe with such success that the old pipe has apparently served its purpose as well as new. Heads up to 350 ft. have been used.

REWINDING A LENGTH OF WOOD STAVE PIPE

A rewinding machine was built up on a bedplate consisting of two 8 x 8-in. timbers 18 ft. long, held rigidly 4 ft. apart by 4 x 6-in. headers and ½-in. iron rods. Two standards or bearings were built up on this bedplate to a height of 3 ft. One of the standards was fixed rigidly to the bedplate and the other was made to slide along to accommodate different lengths of pipe. A socket suitable for a 2-in. iron pipe was cut in the top of each of these bearings. A pair of 6-in. tapered end plugs was made for each diameter of wood pipe to be rewound. Each plug had four radial turning arms 2 ft. long bolted to it. The center of the plugs was bored so that the 2-in. iron pipe could be easily thrust through.

Before being put in the rewinding machine each section of pipe had its staves drawn up together by means of a split ring of ½-in. iron with lug and nut for tightening. The ring was placed around the chime (the chime is the 4-in. section on each end of a wood stave pipe which carries no wiring and is chamfered so it can be driven tightly into a wooden coupling). After cinching the pipe with the split rings, one at each end, the two plugs were driven solidly into place with an 8-lb. maul. The section was then rolled upon skids to place in the rewinding machine, and the 2-in. pipe thrust through the end plugs and rested in the sockets of the two standards. The pipe section could then be rotated easily by means of the end plug handles.

In unwinding, one end of the wire wrapping was pried loose and attached to a reel. Two men, one on the crank on each side of this reel, wound the wire upon it, while a third man guided the wire to place on the reel by moving back and forth a wooden crotch made of two pieces of 1 x 6-ft. timber, 5 ft. long, fastened together like the letter X, the bottom of which rested upon the ground. A man stood at the handles of one of the end plugs to prevent the pipe from rotating too fast and another man worked along the pipe as the wire unwound, ready with hammer and chisel to take out the staples as they were reached.

Best results were not obtained until this reel was moved to a distance of about 75 ft. from the rewinding machine. The reel drum was about 2 ft. in diameter and 1 ft. long, with flanges 4 ft. in diameter. As the wire was unwound, additional ½-in. pipe rings were placed every 4 ft.

When ready to begin rewinding, the end of the wire last removed from the pipe was restapled on the same end from which it was taken and two men at the handles of each end plug rotated the pipe so that the wire would rewind upon it. The old groove in which the wire originally fitted was plainly visible and one man guided the wire into this groove, or as nearly so as feasible, while another constantly hammered the wire to make a snug fit. With very little experience a job closely resembling a machine-wound pipe was produced.

Proper tension on the wire was obtained by placing one end of an 8 x 8-in timber, 16 ft. long, on top of the rewinding reel, the other end of the timber resting on the ground. By sliding the ground end of this timber to or from the reel, the desired tension was secured. It was found possible to replace weakened or broken staves before rewinding, although ordinarily this was not required. When the chimes had been damaged, a new chime was cut on the pipe, space being left for this repair when the pipe was rewound.

With this equipment and the crews mentioned 115 ft. of 14-in. pipe or 75 ft. of 18-in. pipe could be rewound

in a day. The cost for the 14-in. pipe was 24c per foot and for the 18-in. pipe 39c per foot. The diameter of the 18-in. pipe after rewinding was about 17 in.

The Ochoco dam is being built by the sluicing department of the Puget Sound Bridge & Dredging Co., formerly Lewis, Wiley & Morse, Inc., of Seattle.

Water-Waste Survey Shows Defects at Evansville, Ind.

Tests Disclose Broken Pipes, Running Fixtures, Secret Connections and Large Meter Recording Half Its Flow

RESULTS of a water waste survey by the pitometer system, which included the detection of an industrial meter so geared as to be 45 per cent slow, were given at the annual meeting of the Indiana Sanitary and Water Supply Association by Charles Streithof, superintendent of the water department at Evansville, Ind. A 24-hr. record of flow in the two 30-in. mains supplying the distribution system showed 10,245,600 gal. by the pump counters and 10,102,000 gal. by the pitometer measurement, the slippage of the pumps being less than 1½ per cent.

As a preliminary to the main survey two districts having different characteristics were selected. District No. 1, covering 110 blocks, was mainly residential but contained twelve manufacturing plants and two packing houses. The average daily consumption was 1,018,000 gal., and the minimum night rate was 750,000 gal., or 73.6 per cent. Of 350,000 gal. per day in the 12-in. main on Morgan Ave. it was found that 129,000 gal. were metered for industrial use and 36,000 gal. metered by a 6-in. meter of the Evansville Packing Co., while 185,000 gal. passed this meter without being recorded. Although a 4-in. meter at the same plant had not registered since October, 1918, the pitometer tests showed that water was being supplied through this main, while when this was shut off the company had to ask to have it turned on again.

With the larger meter registering incorrectly the loss of water and consequent loss of revenue might have continued indefinite through no fault of the meter reader. After a series of tests this meter was examined by two representatives of the meter company who found that the gear ratio was wrong and the meter was 45 per cent slow. Assuming the low figure of 175,000 gals. per day at 5c. per 1,000 gal. the annual loss to the department has been about $3,200. Investigation showed that when this meter was purchased about three years ago it was fitted with a register of cubic feet. This was changed to a register of gallons and a mistake was made in the gears supplied by the maker for this change.

District No. 2 was in the heart of the city, where the mains and surface piping are about fifty years old. This district of 42 blocks contains hotels, theaters, churches, hospitals, clubs, city hall, police and fire stations, a large part of the business section and many residences, only a few of which are metered. The average daily consumption was 1,043,000 gal. and the minimum night rate 700,000 gal. or 67 per cent. Leaks were discovered where a 1-in. connection discharged into an abandoned vault and three 1-in. services were broken off at the mains.

For the survey of the entire distribution system the city was divided into 15 districts, each divided into two or more sub-districts, depending upon the extent of the territory. In all districts where gaging points were established for sub-division work a permanent vault was built, with an iron manhole cover, so that future tests may be made without tearing up the paving. Traverses were made at all gaging points on mains larger than 6 in. in diameter. In a district which is 100 per cent metered and entirely residential the average daily consumption was 150,000 gal. and the minimum night rate 115,000 gal., or 75 per cent. This district was composed of 56 city blocks, all thickly settled.

The test showed that 35,000 gal. were running to waste at a public school building, where the following fixtures were found to be running continuously, night and day: 30 toilets, 14 urinals, 4 drinking fountains and 7 wash stands. Water was being wasted in all public buildings, particularly those supplied with water at a minimum rate or getting water free. There was 69 house service connections with bad leaks or broken service connections discharging into sewers. One drain line valve was found partly open and three fire hydrants with drain valves disconnected and water discharging into sewers. Several unauthorized connections were also discovered.

Since the completion of the survey the average daily pumpage shows a reduction of 669,000 gal. Although the system is 50 per cent metered, including all large services, it is considered that this survey was well worth its cost. Practically all the valves in the distribution system were operated, and in several instances it was found that pipe lines were not connected, of which the water department had no information. All fire services were tested, unknown to the owners. Several illegal connections were found. The underground leakage located during the survey amounts to over 500,000 gal. per day, which at a rate of 5c. per 1,000 gal. per day would indicate a saving of $25 per day. This amount does not include the under-registration of meters.

Tentative Height Zones for Washington

THE zoning Commission of the District of Columbia has tentatively adopted a plan restricting the height of buildings in four stated districts to 35, 55, 85, and 110 ft. The plan provides that in no case shall the height of buildings exceed the width of the street and that the height of buildings on the corner lots shall be governed by the width of the wider of the two streets, but shall not exceed a depth of 100 ft. measured along the building line of the narrower street. The proposed heights are to be the maximum allowed and no building shall be higher than is provided by an act of Congress June 1, 1912, nor than limited by Section 39a of the District building regulations for 1915. The proposed rules provide that in the 35-ft. height districts various public or semi-public buildings may, upon approval of the Commissioners of the District of Columbia, be carried to a height not over 55 ft. when kept back from the building line not less than 1 ft. for each foot of height in excess of 35 ft.

Highest Mountain in New York

According to t he U. S. Geological Survey the highest mountain in the State of New York is Mount Marcy, a peak on the Adirondacks, which rises 5,344 ft. above sea level. The average or main elevation of the state, as estimated by the Geological Survey, is 900 ft.

Year's Traffic Census on French National Roads Begins

Three General Classifications for Vehicles and Two for Animals — Special Forms for Tabulation Prepared

A TRAFFIC census, to be carried on under the direction of the Minister of Public Works, is to be taken upon the French national highways beginning Aug. 3 and continuing for a year. The census will be in direct charge of chief engineers and division engineers of departments, with whom is left some choice as to the location of traffic count points.

In general, traffic count points established in preceding censuses, notably that of 1913, will again be used in the 1920-1921 census, though additional points will of necessity be chosen in certain locations where recent industrial and railroad expansion has been noted. The census, beginning on Tuesday, Aug. 3, will continue at intervals of thirteen days, ending Wednesday, July 21, 1921. Counts will begin at 5 a. m. from April 1 to September 30, and at 6 p.m. for the rest of the year. They will end at 9 p. m. Night counts will be made, the chief engineer fixing their frequency and points at which they will be made, taking into account local circumstances in such a fashion as to secure as nearly as possible exact representation of night travel.

Vehicles will be classed, as in preceding censuses, in three categories: First, vehicles loaded with produce and merchandise; second, public conveyances loaded or empty; and, third, private conveyances and empty conveyances of any nature, save those named in the second classification. Animals not attached to vehicles will be placed in two classifications: Unharnessed animals such as horses, cattle, mules and donkeys; and small cattle including sheep, calves, swine, and goats. Among the unharnessed animals distinction will be made between those which are mounted by riders, or laden, and those which are neither mounted nor laden. The five following classifications will be made of self-propelled vehicles: (1) Commercial automobiles, (trucks, vans, delivery trucks); (2) auto buses (automobiles used in public passenger transport); (3) private automobiles; (4) motorcycles; (5) velocipedes or other vehicles moved by the feet. No count will be made of pedestrians. Cars traveling upon rails will be made the object of a particular census for which later instructions will be given.

Fig. 1 is a reproduction of the census blanks which will be distributed among those taking the traffic censuses. The passage of each vehicle or of each unharnessed animal is noted by means of a pinhole pierced in the proper column in one of the little squares. Vehicles drawn by donkeys, and pushcarts, are noted in the column of empty vehicles, no matter what loads they carry. Cannon and artillery caissons will be counted as empty vehicles. When unharnessed animals appear in large groups, as in detachments of cavalry or in large herds, their numbers are set down in pencil in larger spaces pro vided for such purposes. Automobile trailers will be noted by as many pinholes as there are trailers. As soon as the count has been finished sheets are totaled and turned over to division engineers who make totals of all counts made in their divisions and who in turn send such totals to the chief engineer of the department in which they operate.

In order to determine the weight and intensity of the traffic, all traffic is referred to a "collier," or a draft horse harnessed to a vehicle. A vehicle loaded with produce or merchandise is counted as one collier; a public conveyance either filled or empty counts as one collier; private vehicles for passengers and empty vehicles of any description, save those noted in the second classification, are counted as ½ collier; unharnessed animals such as horses, cattle, mules, and donkeys count as ¼ of a collier; and small beasts, such as calves, sheep, swine, and goats count as 1-30 of a collier. In order to reduce self-propelled vehicles to the common collier base it will be necessary to weigh enough vehicles of all types to arrive at a mean weight.

	LOADED VEHICLES PRODUCE & MERCHANDISE			PUBLIC CONVEYANCES LOADED OR EMPTY			EMPTY VEHICLES & PRIVATE CONVEYANCES			TOTAL	
		NUMBER OF VEHICLES	NUMBER OF COLLIERS		NUMBER OF VEHICLES	NUMBER OF COLLIERS		NUMBER OF VEHICLES	NUMBER OF COLLIERS	VEHICLES	COLLIERS
1 "Collier"											
2 "Colliers"											
3 "Colliers"											
4 "Colliers"											
5 "Colliers"											
6 "Colliers"											
7 "Colliers"											
8 "Colliers"											
9 "Colliers"											
10 "Colliers"											
Totals											
ANIMALS LADEN OR MOUNTED											
ANIMALS NEITHER LADEN OR MOUNTED											
SMALL CATTLE											

COMMERCIAL AUTOMOBILES	Total
AUTOMOBILES USED IN PUBLIC TRANSPORT	
PRIVATE AUTOMOBILES	
MOTOCYCLES	
VELOCIPEDES	

FIG. 1. CENSUS SHEETS FOR RECORDING TRAFFIC DATA

No reduction of automobiles to colliers is made until after an average weight of those vehicles is available from weighings taken all over the department. The letter P expresses that yet undetermined mean vehicle weight in the following reduction of automobiles to colliers: Commercial automobiles, 1.20 P colliers; autobuses, $\frac{2}{3}$ P colliers; private automobiles, 5 colliers; motorcycles, ½ collier; velocipedes, 1-20 collier.

In order to arrive at a definite determination of the value of a collier, those taking censuses are requested to make as frequent weighings of passing vehicles as is possible. Where it is impossible to weigh passing vehicles information will be sought from drivers as to approximate weights.

From the individual traffic count sheets compilations are made which show the amount of tonnage in kilograms and kilometers, moving over any national highway. Table 1 indicates the method used in determining this tonnage. Gross weight is composed of the dead weight of the vehicle and of the harness, together with the useful weight of the load whether it be persons or produce, merchandise or baggage. The useful tonnage noted in columns 19, 21, 33 and 35 comprises only produce, merchandise and baggage, passengers being omitted. Useful load of private conveyances, of donkey carts, of push carts, of beasts of burden, of private automobiles, of motorcycles and velocipedes is neglected.

In estimating the average weight noted in the odd columns from 13 to 27 due regard is given to the fact that not all vehicles traveling are loaded to capacity. The columns of even number are the product of the columns of odd number by the corresponding length of road.

The table is arranged by roads. For each road, the total weights of traffic are given and the products are found for each section of traffic count. A total is then made of these products, and this total, divided by the length of the road, gives the mean relative weight sustained by the road. At the end of the table there is made a general recapitulation by roads. By the same means employed in the determination of loads sustained by any particular road there is found the total load sustained by all the roads in either a division or a department. The results are only approximate as the lengths are expressed in kilometers with no decimals and the weights in kilograms without fractions.

TABLE I. CHART FOR COMPILING "COLLIERS" AND TONNAGE FROM DATA SUPPLIED BY INDIVIDUAL CENSUS SHEETS

Designation of Roads and Road Sections	Road Lengths (Kilometers)	Average Weight of Animals Harnessed to: Agricultural Vehicles		Public Conveyances		Private Conveyances		Mean Weight of Unharnessed Animals		Mean Weight of Small Cattle		Gross Weight by "Colliers" of: Agricultural Vehicles		Public Conveyances		Private Conveyances		Useful Mean Tonnage By "Colliers" of: Agricultural Vehicles		Public Conveyances		Gross Mean Weight of: Commercial Automobiles		Autobuses		Private Automobiles		Motorcycles		Velocipedes		Mean Useful Tonnage of: Commercial Automobiles		Autobuses	
		Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product	Weight	Product
Column	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

All departmental reports are to be in the hands of the central administration not later than the first of November, 1921.

As a general rule those making the traffic counts will be men employed upon road work, or *cantonniers*. For each traffic count taken during the day the man taking the count will be allowed a half day's salary, or one-fiftieth of his monthly salary. For each count taken at night a pay equal to the salary of a day and a half will be given. If a road worker is called to make counts outside of his district his traffic count pay as noted will be increased by one-fifth, and in case counts are made on Sundays or holidays the pay already noted will be increased with the day's salary.

Shortage in Housing Construction

Building permits issued in twenty-one cities of various sizes widely distributed over the United States show that, in value, housing construction formed 36 per cent of all building in 1913; 21 per cent in 1918; and 27 per cent in 1919, says a recent report emanating from the United States Forest Service. The amount of housing construction in 1913 was exceeded in 1918 in only two of the twenty-one cities, continues the report, and in 1919, in only six, in spite of the "Build a Home" campaign. The falling off in house construction appears to have been most marked since late in 1919 when the greatest upward movement of lumber prices began.

Railway Gage Problem in Australia

RENEWED discussion is taking place in regard to the problem of unifying the railway gages of Australia, according to a report by Consul Edward J. Norton, Sydney, New South Wales, recently published in *Commerce Reports*. Every year the problem is becoming of more pressing importance on account of the increasing extra cost, delay, and inconvenience in transferring of passengers and freight at places where breaks of gage occur.

The following tables indicate the growth in track mileage since 1913 and the existing gages of the Commonwealth railway system, as well as amounts of rolling stock:

MILEAGE OF RAILROAD OF DIFFERENT GAGE IN AUSTRALIA

State	— Track Open — 1913–14 Miles	1917–18 Miles	Existing Gages Ft.	In.
New South Wales	4,251	5,030	4	8½
Victoria	3,886	4,222	5	3
Queensland	5,213	6,679	3	6
South Australia	2,357	3,356	5	3
Western Australia	3,910	4,904	3	6
Tasmania	766	781	3	6
Northern Territory	146	199	3	6

CARS AND LOCOMOTIVES OF DIFFERENT GAGE

Gage	Locomotives	Passenger Cars	Freight Cars
4 feet 8½ inches	1,282	1,659	22,859
5 feet 3 inches	1,038	1,978	24,120
3 feet 6 inches	1,395	1,577	31,600
2 feet 6 inches	17	34	254
2 feet	11	13	211

In 1897 when a conference between the railway commissioners of New South Wales, Victoria, and South Australia made estimates for a conversion to a standard gage, the costs were reported as follows: To a 5-ft. 3 in. gage, $20,730,000; to a 4-ft. 8½-in. gage, $11,500,000. In 1912 another conference of railway engineers representing the six states was held at which the estimates were: To a 5-ft. 3-in. gage, $251,400,000; to a 4-ft. 8½-in. gage, $180,860,000. During the interval from 1897 to 1912 trackage had nearly doubled and construction costs had increased 50 to 150 per cent.

As an indication of the extra transportation costs involved, the junction charges on interstate traffic between New South Wales and Victoria range from 1s. 6d. to 2s. 6d. (from 37 to 61 cents) per ton. On the journey of 3,476 miles from Brisbane to Perth the through passenger is obliged to transfer six times because of the break of gage between connecting lines.

In a report submitted to the Federal Parliament in 1911 the consulting engineer recommended the adoption of a uniform gage of 4 ft. 8½ in. for the railway systems of the commonwealth. The last conference on the subject of a universal gage for the Commonwealth railways was held at Melmourne in August, 1918.

Cracks in New Brick Pavement

By C. C. Wiley
Assistant Professor Highway Engineering, University of Illinois

IN THE spring of 1918, following an unusually severe winter, several peculiar cracks appeared in some of the newest brick pavements in the city of Champaign, Ill. A year later a few more appeared and others are now being watched for. The cracks all occurred in pavements of the newer type, none of which were more than about 5 yr. old. These pavements were exceptionally well built, with well-prepared subgrade, 6-in. concrete base, a 1½-in. sand cushion, and 4-in. brick with asphalt filler. Combined concrete curb and gutter was used. The concrete base was 1:4:8 mix in the

CLOSEUP OF CRACK, SHOWING FILLING STARTED

older sections and 1:3:5 in the newer. The subsoil is principally yellow clay and loam which compacts well and drains readily. There are, however, occasional pockets of heavy clay which drain slowly, and of sandy clay which heave considerably with frost.

The cracks showed on the surface by an opening up of the joints between the brick giving the appearance of a crack in the pavement which was easily traceable with the eye and by a subsidence of the brick due to a shifting of the sand cushion. No displacement of the curb was noticeable to the naked eye. With a single exception the cracks began at the junction between a new and an older and poorer type of pavement, and extended practically parallel to the curb and from 3 to 6 ft. distant from the edge of the brick section for a distance of 50 to 100 ft. The one exception began at a small bridge over which the pavement and curb was continuous but was otherwise typical.

On removing the brick and sand cushion the concrete base was found to be cracked cleanly. The opening varied from ⅛ to ¾ of an inch in width at the junction with the old pavement and gradually tapered out to the point of disappearance. The displacement was entirely lateral as neither section was raised above the other.

Repairs were made by cleaning the cracks thoroughly and then filling them with hot asphalt. The sand cushion was then replaced, the brick relaid and the joints repoured with asphalt. None of these repairs have given any difficulty, are practically invisible, and apparently the cracks have not widened or extended. The accompanying photograph shows one of these cracks while repairs were being made.

It is the general opinion that the cracking was due to frost and that the position of the cracks bears some relation to the location of the drain tile. It seems reasonable to assume that frost was the primary cause but there is no apparent relation between the positions of the tile and the cracks. One crack occurred with a line of tile on each side of the pavement, one with no tile at all, while the remainder are equally divided between the same side and the opposite side to a single line of tile. It therefore appears more probable that the contributing factors were the pockets of different materials previously referred to. This goes to show again the importance of having *uniformity* in the subgrade as against great compactness.

Motor Trucks on Eastern Farms

Some illuminating data have been secured in a recent survey of motor trucks used on farms in the eastern states, made by the United States Department of Agriculture. The survey covers reports from 753 farmer motor truck operators. The farms which these men operate are of all sizes and types and the motor trucks of varying sizes from ½ to 5 tons. The rated capacity of very few of the trucks is greater than 2 tons, however, says the office of Farm Management and Farm Economics, who directed the survey, and nearly half of them are of the 1-ton size. Among the important facts revealed by the investigation are the following:

Only 18 per cent of these farms are less than 5 mi. from markets and nearly one-fourth of them are 20 mi. or more. One-ton trucks are preferred by more men than prefer any other size.

As compared with horses and wagons, the trucks save from one-half to one-thrid of the time required for hauling materials to and from farms.

Farmers have return loads for their trucks about one-fourth of the time.

About one-fourth of the farmers have changed their markets since purchasing trucks, the average distance to the old market being 7 mi. and the average distance to the new one 20 mi.

On the average trucks travel 3,820 mi. per year and are used 173 days per year. The average cost of operation of the ½-ton trucks is about 8c. per mile; of the ¾-ton trucks about 13c.; of the 1-ton trucks about 12c.; of the 1½-ton and 1½-ton trucks about 19c., and of the 2-ton trucks about 20c.

The average cost of hauling crops, including the value of the driver's time at 50c. an hour, is about 50c. per ton-mile with the ½-ton trucks; 34c. with the ¾-ton trucks; 26c. with the 1-ton trucks; 24c. with the 1½- and 1½-ton trucks, and 18c. with the 2-ton trucks.

Milwaukee Testing Station Results on Filtration of Water

Hydraulic Jump Makes Excellent Coagulant Mixer—Ozone Treatment Cost Out of Reason—Slat Underdrains Effective

UTILIZATION of the hydraulic jump to obtain a cheap and effective mixing of coagulating chemicals with the water to be treated is the most striking possibility obtained from the year's experimental work by J. W. Ellms, consulting engineer, Cleveland, O., on the water purification problem at Milwaukee, Wis. That apparatus for sterilization by ozone is not yet developed to the point where it can compete with chlorine is another conclusion backed by plenty of data. High rates of filtration are believed to be feasible, at least the recommended plant will have passages large enough to accommodate a flow of 15 per cent in excess of the normal. A wooden grid strainer system compared favorably with a pipe-manifold strainer system.

Four mixing devices were experimented with: (1) An "around-the-end" series of 22 mixing channels, 60 ft. long, 13 in. deep and 5½ in. wide; (2) a compact "fish ladder" tank, 7 ft. high and 1 x 3 ft. in plan with 17 around-the-end baffles; (3) a "fall," consisting of a 4 x 4-ft. box, 3 ft. deep, near the top of which was placed a 10 x 10-in. receiving tray. The water spilled over the sides of the tray to an apron set at an angle of 45 deg. on which were 1-in. riffle strips. From the apron the water fell on a pile of stones; (4) a "flume" or trough, 28 ft. long, 2 ft. wide and 1 ft. deep, contained 13 riffles, 2 ft. apart and 6 in. high. It was set on a slope to give a 4-ft. drop. Mr. Ellms describes the results of experiments with the mixers as follows:

The poorest mixing action was obtained with the "fall"; some improvement was effected after changes were made in the manner of introducing the chemical solution, but on the whole its action was unsatisfactory. Somewhat better results were obtained with the "fish ladder," but as this device is in reality an "around-the-end" baffled mixing chamber placed vertically, it offered no particular advantage except in taking up but little space.

It was observed when using the mixing chamber that prompt coagulation, which is, of course, an indication of the completeness of the mixing, took place in the first five or six channels, but that the size of the floc had decreased as the water passed through the lower channels. In some cases the flocculation did not make its appearance until seven or eight channels had been passed, reaching its best condition in the tenth and twelfth channels. The long travel, however, appeared unnecessary and even harmful in breaking up the floc.

In order to see whether reduction in the size of the flocculated particles was due merely to the velocity acquired in the straight channels, or was caused by the agitation of the water as it reversed its direction of flow at the ends of the channels, the latter were blocked about 18.9 ft. from the end and new openings cut through the baffle walls. The same number of reversals of the direction of flow was obtained, but the length of travel in each channel was cut down from 60 ft. to 18.9 ft. The results were as satisfactory as those previously obtained, but no more so, although nearly 70 per cent of the chamber has been cut out of service.

The water in flowing down the "flume" formed a series of cascades. An excellent mixing action was produced at a comparatively low velocity of flow. The loss of head, however, was too great. By cutting the flume into two parts and attaching the box known as the "fall," the loss of head was cut down about 25 per cent. The results obtained were good and were secured with a low rate of flow. The device takes up little room as compared with a mixing chamber. Mr. Ellms says:

In the last device an entirely new principle was utilized. By removing the weirs from the "flume," extending it slightly into the receiving box ("fall"), and placing a low weir at the end, there was produced by the rapid flow of the water down the flume a "hydraulic jump." By the impact of the water flowing down the "flume" into the pool back of the weir, a turbulent condition of the water was produced, which effectively mixed the chemical solutions and the water. The chemical solutions were applied at the head of the "flume." The water acquired a velocity of 9 ft. a second in flowing down the "flume," but this velocity was practically all dissipated in complex eddies, at the "jump." Considerable air is trapped in the "jump," and its escape contributes materially to the turbulent condition of the water and consequently improves the mixing action.

The results with this device have been very satisfactory, and the reason for it requires explanation. When a precipitate is the product of a chemical reaction, it first appears in a very finely divided condition. In the case of a colloidal precipitate such as ferric hydroxide or aluminum hydroxide (the two compounds utilized in water purification), the aggregation of these particles into larger masses is necessary, not only to entrap the fine sediment and minute bacteria in the water, but also to prevent them from passing through the sand bed of the filters. It is obvious that violent and continuous agitation of the water will hinder rather than assist in the clotting together of these particles, and hence, to aid this coagulation, a quiescent condition is necessary.

The "hydraulic jump" mixing device provides an extremely rapid and thorough mechanical mixing of the chemical solution and the water to be treated, thereby bringing the reacting substances together and hastening the reaction. Immediately following the "jump" the water flows quietly to a settling basin in which the physical action of coagulation can take place with the least possible amount of agitation, and thereby reduces to a minimum the breaking up of the floc during its formation.

Experiments were made with floats on the actual rate of flow through a four-pass 40,000-gal. settling basin. When run at a rate giving a theoretical displacement period of 7.5 hours they indicated a detention period varying from 4.9 hours to 4.1 hours, corresponding to a linear velocity of 0.46 ft. and 0.56 ft. per minute. At double the theoretical rate the actual velocities varied from 1.24 ft. to 1.1 ft. per minute. This doubling of the actual velocity over the theoretical was rather surprising in view of the shallow depth of tank, 8 to 9 ft. The sliding of the top water over that at the bottom of the tank is in some ways considered undesirable, since it means larger basins. It shows, says the report, that the slowly moving or quiet body of water near the bottom furnishes a zone in which deposition may take place more quickly. The performances of the tank, even with turbidities between 15 and 20 p.p.m., showed a reduction of 67 per cent for a theoretical displacement of 7.5 hours and 45 per cent for 3.75 hours. These results were obtained with alum. With lime and iron the settled water turbidity was always higher than that of the lake water.

Unsatisfactory results were obtained from an attempt to produce an artificial turbidity to improve coagulation. By the addition of an aluminous clay the turbidity was raised from 3 to 21 p.p.m. A larger floc was produced but the filter sands were overloaded with clay, which the washing did not remove. Effluents were slightly turbid at the beginning of a run. Since the turbidity of

21 p.p.m. was brought down to 7 p.p.m. in the water applied to the filters, the investigators concluded that there was not too great a volume of sediment passing to the filters.

Wooden Grid Strainer System

Two filters, 5 x 5 ft. 8½ in. in area, equivalent to 0.001 acre, had a depth of 9 ft. A U-shaped gutter extending through the center of the tank had its edge 2.5 ft. above the 35-in. sand layer which rested on a 16 to 18-in. gravel layer.

The wooden grid strainer system in one filter consisted of 1 x 6-in. boards set on edge 1 in. apart, giving a 50 per cent opening. The underside of the grid was placed 6.5 in. above the bottom of the filter box. The perforated pipe system in the second filter was provided with openings of 0.3 per cent area of the bed. Pipe laterals of 1½-in. pipe with ½-in. perforations placed 2½ in. c. to c. and staggered were used. Of these filters the report states:

The rate at which the filters were washed was from 16 to 19 in. per minute, with a rate of 20 or 21 in. per minute when the wash water valve was first opened. It was somewhat unfortunate that it was not possible to wash at higher rates for experimental purposes. While flotation of the sand was always affected and the sand bed properly cleaned each time, it may have required somewhat more wash water to do the work than would have been needed with a higher pressure. The distance between the sand and the edge of the wash trough was 30 in., and was probably higher than was needed for the washing rate available.

The pipe manifold strainer system gave satisfactory results, and is a safe and conservative design. Nothing developed in its use experimentally that indicated that it could not be employed locally in the design of a municipal plant.

The wooden grid strainer system also gave good results. Toward the end of the work an examination was made of the filtered water well immediately under the grid in order to see whether sand had worked its way down through the gravel bed. None was found. Examination from above showed the gravel bed to be in good shape also.

In spite of the absence of trouble with this form of strainer, it is believed that had there been available a wash water pressure capable of producing an upward velocity of 2 to 2.5 ft. per minute, the bed might have been "blown up" and ruined. What has not been established is the necessary depth of the gravel layer below the sand to prevent a hole being blown through the gavel, thereby disrupting the bed. If high velocities through the gravel can be properly controlled by a sufficient depth and by proper grading of the gravel, it is believed that the grid will furnish a comparatively cheap, simple and effective type of strainer. Further experiments for the purpose of establishing the truth or falsity of the points noted are necessary before it could be safely adopted for use in a large plant.

"Breaking" Lengthens Runs

Diatoms are never present in less numbers than 100 to 125 organisms per c.c. Operating periods of the filters were accordingly short, the shortest less than an hour. "Breaking" was tried with the results described as follows:

"Breaking" consisted in closing the effluent valve of the filter and opening the wash water valve for about half a minute. The rising wash water breaks the surface of the sand bed, throwing the deposited matter into suspension or displacing it so that a fresh surface of sand is exposed down through which water may filter. After the wash water valve is closed, the effluent valve is again opened and filtration resumed.

The "breaking" of a filter usually may be done twice to advantage. Periods of service are lengthened from 200 to 300 per cent. The wash water percentages are proportionately diminished since no wash water is really lost in the breaking process, although such as is used must be refiltered and repumped. A gain of 10 to 15 hours in the length of the run and a reduction of 2.5 to 3 per cent in the wash water may be effected by "breaking."

In order to determine the effect on the quality of the filtered water of "breaking" the sand beds, a series of special samples were obtained. The average results were:

	Bacteria, per c.c.	B. Coli Index per c.c.
Applied water	250	0.86
Filtered water:		
Just before first "break"	64	0.04
Fifteen minutes after first "break"	100	0.78
Just before second "break"	164	0.17
Fifteen minutes after second "break"	77	0.98
Just before regular 4-minute wash	82	0.12
Fifteen minutes after regular wash	210	2.03

Ozone Experiment

The following statements regarding the ozone apparatus and the results which it gave have been taken from the report:

The ozone apparatus consisted of three water towers connected together by pipes, an ozone generator, air compressor, equalizing air pressure tank, and switchboard with the various electrical switches, watt, volt and ampere meters. In addition, a water meter, an air meter and thermometers for registering the temperature of the air entering and leaving the ozone generator were used. Raw or filtered water could be passed through the ozone plant. Each tower was 8 ft. high and 1 ft. in diameter. The towers were placed in steps so the water could flow by gravity from the highest to the lowest tower through connecting pipes. The water entered each tower 4 in. below the top, and discharged at the bottom of the tower into the riser pipe of the next lower tower. The tops of the tower were vented to the outside atmosphere to allow for the escape of excess or ozonized air.

The ozonized air pipes entered in each case at the bottom of the tower. The rising air containing the ozone passed through the descending water in a continuous stream of small bubbles. The ozonized air pipe was trapped by being carried above the level of the water in the towers in order to prevent water backing over into the ozone generator.

The ozone generator was contained in a cylindrical metal tank, capable of withstanding the air pressure required to overcome the head of water in the towers, or about 4 lb. per square inch. It had three compartments. The first received the entering air and acted as a sort of equalizing reservoir. From the first compartment the air passed through orifices, designed to impart a uniform flow into the middle compartments.

In the middle compartment were the frames for holding the electrodes, which consisted of aluminum foil, 9 x 15 in. in size. Between them were micanite dielectrics, 12 x 18 in. in size. The spacing apart of the electrodes was from ⅛ in. to ¼ in. The ozonized air produced by the electrical discharge between the electrodes passed from the middle compartment to the third compartment through distributing orifices, and thence through a pipe line to the three water towers.

In making the ozone, a single phase alternating electric current of 220 volts and 60 cycles was passed through an oil-cooled transformer, capable of providing a secondary voltage as high as 20,000. One side of the secondary coil of the transformer, the container and one side of the ozone generating circuit were grounded to insure safety against the highly dangerous voltages required in case of short circuits or leakages of current.

At the request of the manufacturers of this apparatus, The Ozone Co. of America, Milwaukee, they were permitted to install a mechanical mixing device to replace the towers first used. This emulsifier consisted of a 10-in. cast-iron pipe about 5 ft. long, laid horizontally. Through the center of the pipe passed a shaft carrying oval-shaped mixing paddles made of wire netting. The paddles were set at an

angle of about 30 deg. to the axis of the shaft. Adjoining paddles inclined toward each other on one side, and away from each other on the opposite side of the axis of the shaft. The water entered at one end of the emulsifier and passed out at the opposite end. Provision for applying ozonized air was made at a number of points along the bottom. The shaft was rotated at a rate of about 154 r.p.m. The sweeping action of the paddles distributed the ozonized air throughout the water with considerable uniformity. The capacity of this device was about 10 gal. per minute as compared with about 6 gal. per minute when the towers were used.

Each tower held approximately 40 gal. of water. The average volume of water flowing while using the towers was 6.5 gal. per minute. At this rate it would require about 6 min. for the water to pass through one tower. The average volume of air applied was 5.48 cu.ft. per minute. As the water received three successive treatments with ozone it was exposed to the ozonized air at the rates noted above for a total period of 18 to 20 min. Assuming a 20-min. contact with air entering at the rate of 5.48 cu.ft. per min., there were used 109.6 cu.ft., or practically 3.1 cu.m. The average weight of ozone in each cubic meter of air for the period that the towers were used was 0.52 gram. This is equivalent to 0.04 per cent of the weight of the air.

Bactericidal Action Good

It is evident from even a short study of the results that good bactericidal action has been obtained in both raw and filtered water. The exceptions to the rule are usually easily accounted for. They generally arise from using too low voltages on the ozonizer, applying too small a volume of air, or purposely working the apparatus improperly in order to learn the effect of some particular set of conditions. Ozone, like chlorine, however, is not always able to care for the sudden appearance of excessive numbers of bacteria, a condition that is frequently met with in the Milwaukee water supply. It only adds emphasis to the need for a first line of defense, such as is afforded by a filtration plant. The average quantity of ozone applied to the water in parts per million was 2.17. Before reconstructing the ozonizers the average amount used in treating the water was 2.97 p.p.m., whereas after rebuilding, the average was but 1.56 p.p.m.

Assuming the ozonizer was one of several units required to treat a million gallons of water in 24 hours, then the energy needed to produce results equivalent to those obtained in the experimental apparatus would average 600 kw.-hr. Before reconstructing the ozonier, the average number of kilowatt-hours per million gallons estimated on the above assumption would be 802, while after rebuilding the apparatus it fell to 431. Good results might be expected with an energy output per million gallons of about 200 kw.-hr., and the application of from 1.0 to 1.5 p.p.m. of ozone, if the number of bacteria did not exceed about 1,000 per c.c. With higher bacterial content more ozone would be needed, and in consequence a greater output of electrical energy. These figures might be modified somewhat if more efficient methods of applying the ozone were developed.

Additional Costs

It should also be borne in mind that the above estimates of power relate only to the production of the ozone. To the cost of power to produce the ozone must be added the cost of power for pumping in order to overcome the friction head due to the flow of water through any form of treating apparatus, for any mechanical stirring device, if such were used, and for the compression and forcing of the air through the ozone apparatus and water. If drying of the air by refrigeration should be found necessary, then this cost too must be added to those cited.

The Milwaukee experiments were carried out by Ernest F. Badger under the direction of J. W. Ellms, consulting engineer, Cleveland, reporting to H. P. Bohmann, superintendent of water-works and water purification.

Detail Design of Riveted Joints of Bridge Trusses

Riveting Determined by Study of Paths of Forces Concentrated at Joint by the Members Connected—Two Examples

By Major W. M. Wilson
Professor of Structural Engineering, University of Illinois, Urbana

THE design of structural details is not as well standardized as the design of the main members of a structure. In fact, many structural engineers are reluctant to use the term "design" in connection with details, showing that they do not consider it necessary to analyze the stresses or trace the paths of the forces the same as they do in the design of the main members. Although it is not always possible to analyze the stresses in a connection satisfactorily, it is the

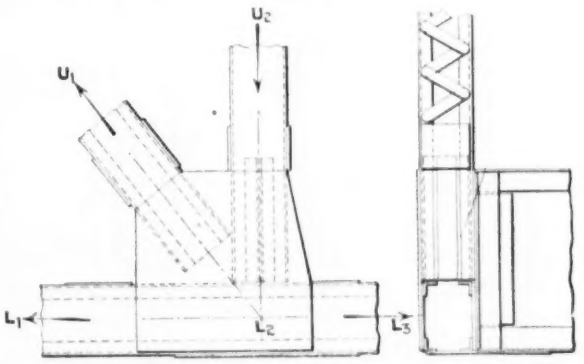


FIG. 1. GUSSET-PLATE CONNECTION AT BOTTOM-CHORD JOINT OF RIVETED TRUSS

opinion of the writer that a more careful study of joints will lead to better details.

Many designers in determining the number of rivets required at the panel points of the bottom chord of a through riveted truss use a method that fails to consider the action of the parts connected, and therefore leads to faulty results. Such a joint will be discussed here.

Fig. 1 represents the second panel point of the bottom chord of a truss. The forces acting upon this connection are the floorbeam shear, acting downward; the compression in the post U_2L_2, acting downward; the tension in the diagonal U_1L_2, acting upward to the left; the tension in L_1L_2, acting to the left; and the tension in L_2L_3, acting to the right. These forces must pass through the gusset plates.

To determine the rivets required in the different parts of the joint, trace the paths of the forces, beginning with the end shear on the floor-beam. The end shear is transmitted from the floorbeam to the inside gusset plate. Half of this shear is delivered by the inside gusset plate directly to the diagonal U_1L_2 and the other half is delivered by the gusset plate to the inside flange of U_2L_2. This latter part is then transmitted through the diaphragm in the lower end of the post to the outside gusset plate, and from the outside gusset plate to the diagonal U_1L_2. The stress from the post, a downward force, is delivered one-half to the inside gusset plate and one-half to the outside gusset plate.

Having now in mind the paths of the forces, we will next consider the stresses upon the rivets. The rivets through the outstanding legs of the floor-beam connec-

tion angles are in single shear, and they develop the entire end shear in the floor beam. Contrary to a common opinion among many structural engineers, the writer contends that all of the rivets connecting the floor-beam to the gusset plate, including the rivets below the vertical post, help to develop the end shear of the floor-beam. The reason for this contention is that, even though these latter rivets do not pass through the vertical post, they do pass through the inside gusset plate; and, hence, are capable of transmitting force from the floor-beam to the gusset plate. The fact that half of the end shear of the floor-beam is transmitted directly from the inside gusset plate to the diagonal, makes it unnecessary for all the stress delivered to the gusset plate by the floor-beam to be delivered to the vertical post.

Consider next the rivets connecting the inside gusset

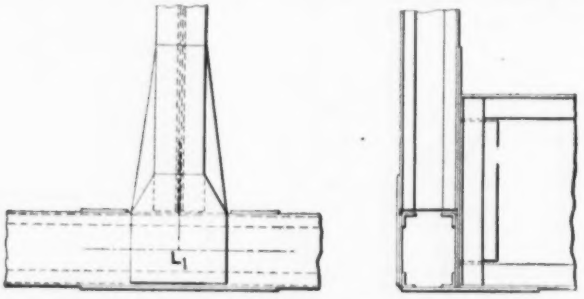


FIG. 2. CONNECTION OF FLOORBEAM TO HIP VERTICAL BY SIMPLE GUSSET PLATE

plate to the vertical post. The vertical forces acting on this gusset plate are as follows: On the inside is the shear from the floor-beam, acting downward. On the outside is half of the stress in the post, acting downward, and the shear in the diaphragm, acting upward. The shear in the diaphragm is one-half of the floor-beam shear. In addition to these, the vertical component of the stress delivered by the inside gusset plate to the diagonal, acts upward. The sum of these vertical forces must be zero. The shear between the gusset plate and the vertical post is the numerical difference between one-half the shear in the floor-beam and one-half the stress in the post. This resultant force must be developed by the rivets which pass through the gusset plate and through the vertical post.

Consider next the rivets connecting the outside gusset plate and the vertical post. One-half of the floor-beam shear has been transmitted through the diaphragm at the lower end of the post to the outside gusset plate. This acts as a downward force upon the plate. Half of the stress in the vertical post is also delivered to the outside gusset plate. This also acts as a downward force.

The total shear, therefore, between the outside gusset plate and the vertical post is the numerical sum of one-half the floor-beam shear and one-half the stress in the vertical post. This quantity is the sum of simultaneous stresses and its maximum value cannot be determined by adding one-half the maximum post stress and one-half the maximum floor-beam shear. But, inasmuch as the vertical component of the stress in U_1L_2 must always balance the stress in the vertical post and the floor-beam shear, the maximum shear between the vertical post and the outside gusset plate is one-half of the vertical component of the maximum stress in U_1L_2. The fact that half of the stress U_1L_2 comes f[rom] each gusset plate is a check upon this statement.

Inasmuch as the shear between the post and the [out]side gusset plate is the numerical sum of two forc[es] whereas the shear between the vertical post and [the] inside gusset plate is the numerical difference betw[een] the same forces, the shear between the post and [the] outside gusset plate is always greater than the sh[ear] between the post and the inside gusset plate.

As a result of the above discussion, the writer recom[-] mends the following method of determining the numb[er] of rivets required for the joint L_2:

(1) The rivets through the outstanding leg of the connection angles of the floor-beam shall develop the end shear in the floor-beam. These rivets shall include the rivets below the vertical post.

(2) The rivets connecting the vertical post with the outside gusset plate shall develop one-half the vertical component of the stress in U_1L_2. These rivets do not include the rivets below the vertical post.

(3) The rivets connecting the diaphragm to the inside and also to the outside flange of the post shall develop one half the end shear in the floor-beam.

Fig. 2 shows a typical detail for the connection of the floor-beam at L_1 of a riveted truss. With this connection, the end shear of the floor-beam is delivered from the floor-beam connection angle to the inside gusset plate and from the inside gusset plate to the hip vertical. Half of this shear is taken by the inside flange of the hip vertical; the other half is delivered by the diaphragm or the web of the hip vertical to the outside flange.

The writer, therefore, recommends the following method for determining the number of rivets in the connection at L_1:

(1) The rivets through the outstanding leg of the floorbeam connection angle shall develop the end shear in the floorbeam. These rivets may include the rivets below the hip vertical.

(2) The rivets connecting the gusset plate to the hip vertical shall develop the end shear on the floorbeam. If there is not an excess of rivets through the outstanding leg of the floorbeam connection angles, it will be necessary to extend the inside gusset plate above the floorbeam far enough to put as many rivets above the floorbeam as there are below the hip vertical.

(3) If the hip vertical does not contain a web plate, a diaphragm must be used at the bottom. The rivets connecting the diaphragm to the inside flange and also to the outside flange of the hip vertical must develop one-half of the shear in the floorbeam.

(4) The outside gusset plate need contain only enough rivets to support the bottom chord as they do not develop any of the stress in the hip vertical.

Utilizing the fact that the rivets below the vertical post help develop the floorbeam shear, reduces the cost of the joint. Moreover, a careful study of the paths of the forces establishes the fact that these rivets do help develop the floorbeam shear.

Progress on U. S. Topographic Map

On July 1, 1919, according to the U. S. Geological Survey, 42.6 per cent of the topographic map of the continental United States, exclusive of Alaska, had been completed. Approximately one-fifth of this area is in need of re-survey, leaving 35 per cent of the entire country covered by satisfactory maps.

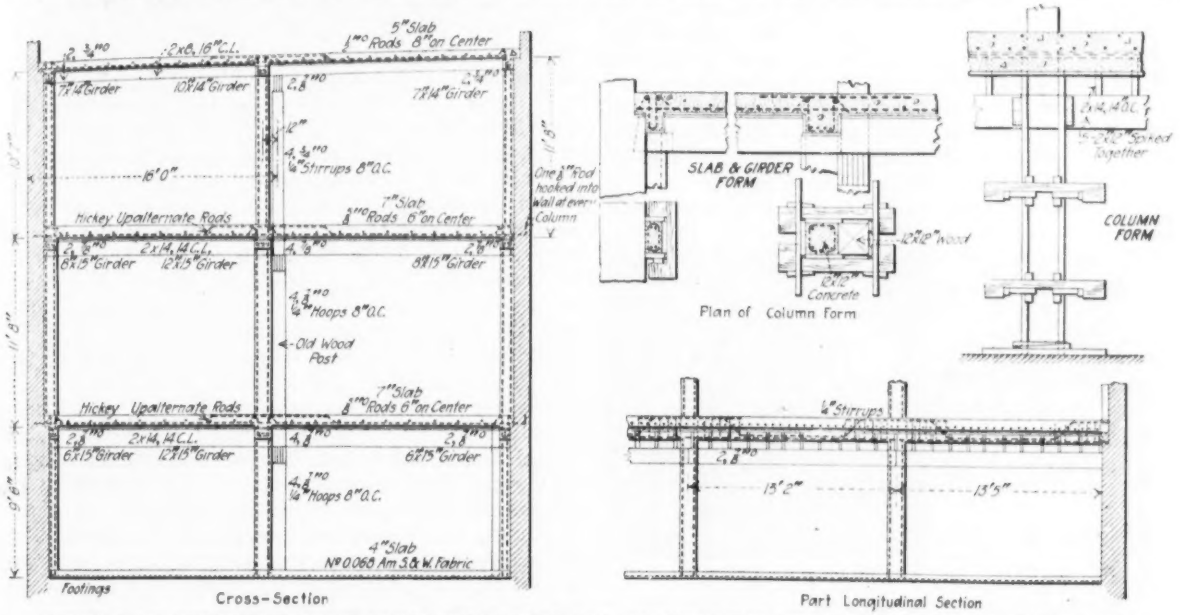
Concrete Replaces Wood as Frame of Existing Warehouses

Old Floors and Columns Used as Falsework in the Transformation of Buildings into Fire-Resisting Type

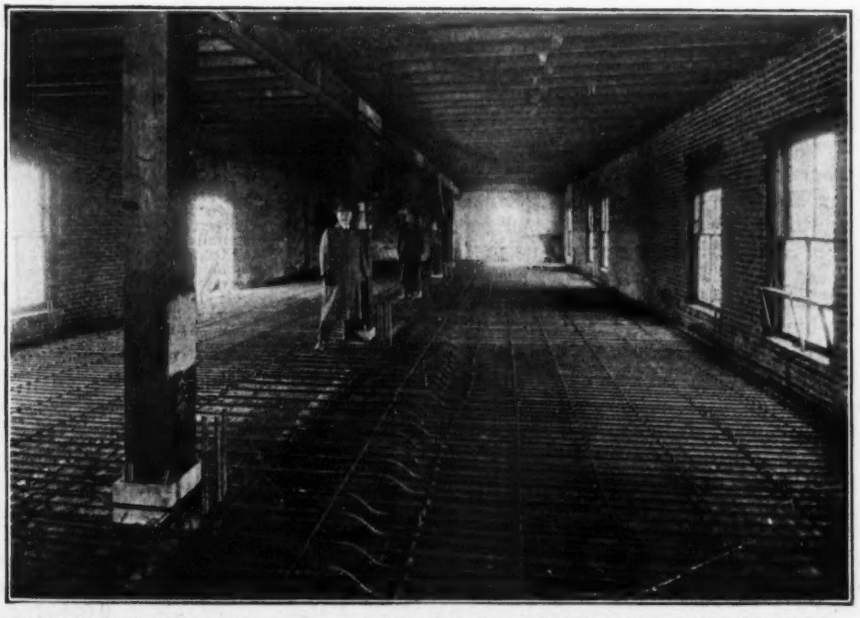
OLD timber floor and column construction is being replaced in some warehouse buildings in Kansas City by reinforced-concrete floors and columns placed without materially disturbing the total contents of the building and at the same time utilizing the old floors and columns for the forms and centers for the new framework. The carrying capacity of the floors is increased and the building is given a very much higher degree of fire resistance. At the same time considerable money is saved in the utilization of the old structure for form work. These buildings have been rebuilt under the direction of E. Lee Heidenreich, consulting engineer, of Kansas City.

A typical reconstruction job is shown in the accompanying drawing and photograph. This building is a three-story brick-wall structure with interior wooden framework and has an outside plan of 32 x 153 ft. Transverse 2 x 14-in. joists 14 in. on center, span a 32-ft. opening, with intermediate lines of stringers made up of spiked 2 x 14-in. plank resting on 12 x 12-in. square wood posts. The reconstructed floor consists of a 7-in. reinforced-concrete slab supported by a middle longitudinal 12 x 15-in. reinforced concrete stringer on 12 x 12-in. concrete columns and two marginal girders of varying dimensions, as shown on the drawings, supported on concrete columns at the brick walls. The roof, as shown, is of the same general design but of smaller dimensions.

The new concrete columns are offset just outside the old wooden posts so that one of the new concrete spans is 17 ft. out of wall to centre of column, and the other 15 ft. In construction one floor is laid at a time and the material on the floor moved to an adjacent floor, merely during the reconstruction operations. The wooden floor is used as the bottom form for the concrete floor and a "trench" cut through the 14-in. joists a depth of 8 in. makes the forms for each of the



DETAILS OF SUBSTITUTION OF CONCRETE FLOORS AND COLUMNS FOR WOOD MEMBERS IN OLD BUILDING



REINFORCEMENT IN PLACE FOR NEW CONCRETE FLOORS USING OLD WOODEN FLOORS AS FALSEWORK

girders. Column forms consist of three vertical planks forming three sides of the concrete column and the old wood post forming the fourth side. These forms are held in place by wedged wooden ties fastened to the wood posts, as shown in the detail. The new floor is designed to carry a load of 125 lb. per square foot. The extensive load from the columns to the foundations is taken care of by underpinning and increasing the size of the piers.

Belgian Highways

BELGIUM is beginning to feel on her highways the strain of the motor truck. The roads on her national system are almost entirely of stone block laid on sand and sand jointed. On account of the heavier traffic, when these roads are renewed concrete foundations are generally used and the joints are grouted. The older type of road had a life of from 15 to 20 years.

During the German occupation only such roads were

ROAD ROLLER ON BELGIAN HIGHWAY
Driven by Gasoline Engine on Shaft Inside Roller and Steered by Smaller Roller

kept up as were needed for war purposes. The highway system, as a whole, therefore, is not in good repair. Financial conditions are such, too, that restoration cannot proceed at a very rapid rate. Even if the former type of construction were to be continued, the present cost would be about 50 francs (about $9.50 at normal exchange rates) per square meter, compared with a pre-war cost of 12 francs.

Some tar-macadam has been used, but on the whole stone-block construction is preferred. Just now, because of shortage of block, considerable waterbound macadam is being laid as an emergency measure. Concrete has been laid only in experimental sections and conclusions regarding it have, apparently, not been drawn.

For stone block, porphyry is preferred, except on grades where a hard sandstone, called *grès*, is used. The latter is gritty and gives a better foothold than porphyry.

The national highway system, totaling 8,000 km., is built and maintained solely by the national government, even where the roads run through towns and cities. The provincial and communal roads are built and maintained solely at the expense of the respective political divisions. Maintenance costs on the national systems, the *grandes routes*, averaged, before the war, 1,000 francs per kilometer (about $316 per mile), but this was considered an inadequate expenditure; in other words, the maintenance standards were below those deemed desirable by the technical staff. The amount stated was all the Parliament would allow.

The paved width of the *grandes routes* has bee minimum of 5 m., except through towns. When reb the minimum width is made 6 m.

Water-Power Control in England

IN A second report the Water Power Resources Co mittee, recently organized in Great Britain, has ma certain recommendations toward the control of the wat resources of the country and the jurisdiction over wat power.

The committee recommends that either the Board o Trade or the Electricity Commissioner should be specif ically charged with the duty of studying, supervisin and promoting water-power deve'opments, although it was stated before the committee that there was comparatively little water power in England and Wales remaining to be developed. The committee thinks that its preliminary investigations did not justify this view. There are several parts of Great Britain in which there are large sources of water power but very few inhabitants. It is unlikely that such sources, according to the committee, will be developed unless some state assistance is available, and the committee recommends that the department charged with the duty of developing water power should be provided with a fund for the purpose of starting enterprises in such areas.

The committee further recommends that there should be established by act of Parliament a controlling water commission having jurisdiction over England and Wales, who would have among its duties the compilation of records of water resources, the allocation of these resources, in the general interest of the community, the adjustment of conflicting interests, and the consideration of the development of rivers as a whole from point of view of all water interests.

A final report dealing more fully with water power and with the amendments required in the law as to pollution, underground water, and kindred subjects is expected soon.

Data on Permeability of Rubber to Gases

According to experiments recently made at the Bureau of Standards by J. D. Edwards and S. F. Pickering, the relative ease of passage of various gases through sheet rubber is expressed by the following table:

Kind of Gas	Relative Permeability, Hydrogen = 1
Nitrogen	0.16
Air	0.22
Argon	0.26
Oxygen	0.45
Helium	0.65
Hydrogen	1.00
Carbon dioxide	2.9
Ammonia	8.0
Methyl chloride	18.5
Ethyl chloride	200.0
Water vapor, approximately	50

The permeability varies directly with the partial pressure of the gas (under constant total pressure) and is inversely proportional to the thickness of the rubber (this was measured only for hydrogen). It varies rapidly with temperature; at 100 deg. C., the permeability to hydrogen was 22 times that at 0 deg. C. and to carbon dioxide 17 times the rate at 0 deg. Rubber that is old and brittle, or has been over-vulcanized, is low in permeability. At 25 deg. C. the permeability of vulcanized dental dam rubber was found to be about 0.00002 cu.cm. per min. per sq.cm. of surface. A report of the tests will soon be published.

Costs of Upkeep and Repairs on a Large Building

Records of Labor and Materials in Maintaining Printing Plant for Eight Years Give Annual Itemized Costs

By Walter R. Metz
Mechanical Engineer, Takoma Park, Md.

RECORDS of cost of upkeep of buildings and their component parts seem to be very scarce and it is probable that the average owner does not know which items cover the biggest parts of his expense or where the "leaks" might be. It is for this reason that the following figures are given and it is hoped that it will prompt some readers to give their experiences.

It might be stated that the costs as given cover a group of ten buildings all connected together but not all under one roof. The main building is seven stories high and the other buildings are from four to six stories high. All of the buildings were designed for heavy loads and heavy machinery and are used for a printing plant. The floors in the main building were designed for loads of 300 lb. per sq.ft. and in the other buildings 200 lb. per sq.ft.

Costs have been given for each year from 1912 to 1919 inclusive and indicates the gradually increased cost of both labor and materials.

Floors

All floors were leveled up with concrete and finished with hard maple blocks 2¼ x 12 x ⅞ in., cut with interlocking grooves and projections on the sides and near the lower faces of the blocks. These blocks were dipped so as to coat the under side with hot bituminous mastic and applied to the concrete, which had been previously prepared by giving it a coat of bituminous varnish. The total area of the floors, in round numbers, is 250,600 sq.ft.

Year	Labor	Material	Total	Cost per Square
1919	$2,387.69	$267.48	$2,655.17	$1.06
1918	2,787.91	132.57	2,920.48	1.16
1917	2,454.53	202.30	2,656.83	1.06
1916	1,178.37	125.31	1,303.68	.52
1915	1,058.33	99.01	1,167.34	.46
1914	1,005.17	57.86	1,063.03	.42
1913	1,336.54	95.87	1,432.41	.57
1912	1,055.09	121.59	1,176.68	.47

Roof

The roof is of reinforced-concrete slabs supported by steel beams. It was finished with flat vitrified tiles, laid on a base of Neufchatel asphalt mastic. The mastic was applied in two coats with a layer of fine wire netting between to serve as a bond. Each tile was stuck fast to the mastic with a spoonful of bituminous cement. The inclination of the roof is about 1 to 7. This is rather steep for tiles on an asphalt base but the whole roof has stood up remarkably well. The total area of tile roofing is 50,700 sq.ft.

Year	Labor	Materials	Total	Cost per Square
1919	$726.91	$16.20	$743.11	$1.46
1918	2,038.80	459.96	2,478.76	4.88
1917	392.38	12.82	405.20	.79
1916	643.78	166.03	809.81	1.59
1915	102.13	4.95	107.08	.21
1914	657.96	89.33	747.29	1.47
1913	493.70	36.94	476.64	.94
1912	239.11	28.54	267.65	.52

Steam Heating.—The total volume of the main building is 7,600,000 cu.ft. The system of heating is the direct-indirect, the coils being placed in pockets under the windows with dampers for admitting fresh air and baffles for deflecting the air to the floor, whence it would have to rise through the coils. The total radiation is 70,000 sq.ft., consisting of 694 steam coils and 35 cast-iron radiators. The ratio of heating surface to the volume of the building is 108.

In addition to this there is approximately 30,000 sq.ft. of radiation in coils in the other buildings, making the total radiation approximately 100,000 sq.ft.

Year	Labor	Material	Total	Cost per 100 Sq.Ft. of Radiation
1919	$3,928.23	$601.46	$4,529.69	$4.53
1918	2,631.21	2,000.38	4,631.59	4.63
1917	3,823.02	523.04	4,346.06	4.34
1916	3,183.45	694.11	3,877.56	3.87
1915	2,635.52	222.35	2,857.87	2.85
1914	2,643.43	399.83	3,043.26	3.04
1913	2,870.56	480.71	3,351.27	3.35
1912	2,436.34	343.97	2,780.31	2.78

Plaster

Plaster on ceilings was applied to a concrete surface and three coats of plaster were applied. The first and second coats were heavily gaged with portland cement, the idea being to secure a hard plaster. Around beams the plaster was applied to wire mesh. The plaster was rather thick and it is believed it would have lasted better if it had been applied thinner, say about ¾ in. thick. The plaster on practically every beam either fell or had to be removed after about eight or ten years' use, but that on the ceilings is still in good shape although about 18 years old. The total area of plastered surface is approximately 360,000 sq.ft.

Year	Labor	Material	Total	Cost per Square
1919	$993.63	$21.83	$1,015.46	$0.28
1918	62.61		62.61	.017
1917	9,026.52	956.49	9,983.01	2.77
1916	2,659.62	409.81	3,069.43	.85
1915	681.68	51.66	733.34	.20
1914	466.66	3.59	470.25	.13
1913	858.77	38.44	897.21	.24
1912	578.42	96.47	674.89	.18

Doors

There are 223 doors of all sizes and types in the buildings, single-acting hinged office doors, double-acting, plain sliding, and automatic sliding fire doors. These doors receive very hard usage and need constant attention. Practically all of the double-acting doors have wire glass in the upper panels.

Year	Labor	Material	Total	Cost per Door
1919	$564.58	$109.18	$673.76	$3.02
1918	883.44	182.91	1,066.35	4.78
1917	598.88	185.03	783.91	3.51
1916	910.38	224.22	1,134.60	5.08
1915	691.04	148.46	839.50	3.76
1914	855.72	143.85	1,099.57	4.93
1913	440.42	130.28	570.70	2.56
1912	435.80	142.81	578.61	2.59

Windows

There are 2,290 windows in the buildings, most of them of the double-hung sliding type with a few of the hinged type. Glass sizes vary from 12 x 18 in. to 36 x 50 in.

Year	Labor	Material	Total	Cost per Window
1919	$593.67	$220.26	$713.93	$0.31
1918	794.70	294.87	1,089.57	.47
1917	486.97	161.72	648.69	.28
1916	729.51	191.99	921.50	.40
1915	421.47	76.46	497.93	.21
1914	758.72	168.70	927.42	.40
1913	474.50	108.95	583.45	.25
1912	564.12	174.40	738.52	.32

Plumbing:—Fixtures in the building consist of 240 water closets, 338 washbasins, 90 urinals, 21 slop sinks, 120 drinking fountains, 80 fire hose and racks. The repairs includes, of course, repairs to the necessary piping as well as to repairs to fixtures. It is difficult to find any unit basis so total amounts only are given.

Year	Labor	Material	Total
1919	$5,304 63	$406 08	$5,810 71
1918	5,309 31	352 87	5,662 18
1917	4,530 09	556 05	5,086 14
1916	3,291 66	464 90	3,756 56
1915	2,974 87	237 93	3,212 80
1914	2,941 40	238 95	3,180 35
913	2,738 26	395 26	3,133 52
1912	2,250 82	160 36	2,411 18

Presaturated Sand Facilitates Concrete Mixing

Outlet Works at Taylorsville Dam Last of Major Concreting Operations for Miami Valley Flood Control Works

CONSTANCY of mortar volume and increased speed and smoothness of mixing, are being secured by wetting the sand to saturation in proportioning concrete for the Taylorsville dam of the Miami valley flood protection works. Water is added to the sand until it contains all that it will retain by capillarity. This procedure combined with excavation from different parts of the pit as a finer or a coarser mixture is wanted is standardizing very successfully a washer product where the pit materials run irregular.

Of the five outlet structures, that at Taylorsville is the only one where major concreting operations are not completed. The structure requires about 55,000 cu.yd. of concrete mainly in massive walls and floor slabs. In general the outfit and procedure for making and distributing concrete are those described in *Engineering News-Record*, Oct. 2, 1919, p. 640, and are plainly indicated by the illustration. With this outfit records of 500 cu.yd per day of concrete in place have been made.

Concrete proportioning on the Miami work is done on the principle of density of the combined aggre Tests of the local gravel at Taylorsville demonstr that the most dense gravel mixture was obtained by bining equal parts of coarse (1½- to 3-in.) gravel an small (¾- to 1½-in.) gravel. Further tests to deter the volume of sand which would, with the gravel ture, give the most dense combined mixture, disc the facts: (1) That sand as drawn from the was sand bin contained varying amounts of moisture; that varying amounts of moisture in the sand ga varying volumes of mortar per measure of sand, a (3) that sand saturated with water gave a consta volume of mortar and also, with the gravel mixture, t most dense combined mixture. Considering a 1-cu.yd mixer batch, 16-cu.ft. of coarse gravel and 16-cu.ft. o small gravel and 13-cu.ft. of saturated sand gave a 30 cu.ft. batch. This was the minimum volume which could be secured by any combination and was adopted as the standard working mixture.

To saturate the sand, water is run into the measuring chute, a prescribed quantity determined by experience being admitted. The final adjustment of water in the concrete is made by jetting water into the mixer until the desired consistency, judged by the eye, is secured.

The use of the saturated sand has practical advantages besides that of keeping the mortar volume constant. The charge flows more easily into the mixer and the materials mingle more readily. The mixing process is more rapid. The newly charged material has less tendency to ride up the rising side of the mixer and to spill out. Since danger of loss by spilling is lessened the size of the batch can be increased. For example, in placing 3,000 cu.yd., measured in the forms, the 1-cu.yd. mixer averaged 1.2 cu.yd. per batch.

The Taylorsville dam forms one of the flood water detention reservoirs being constructed by the Miami Conservancy District, Arthur E. Morgan, chief engineer; Charles H. Paul, assistant chief engineer, and C. H. Locher, construction manager. O. N. Floyd is division engineer in charge of the dam construction.

TRAIN UNLOADS INTO WASHER HOPPER
GRAVEL WASHER AND SCREENING PLANT
DRAGLINE LOADS GRAVEL CARS
CEMENT TRAIN
FOUR-CAR TRAINS TAKE GRAVEL TO WASHING PLANT
LIFT TO FORMS

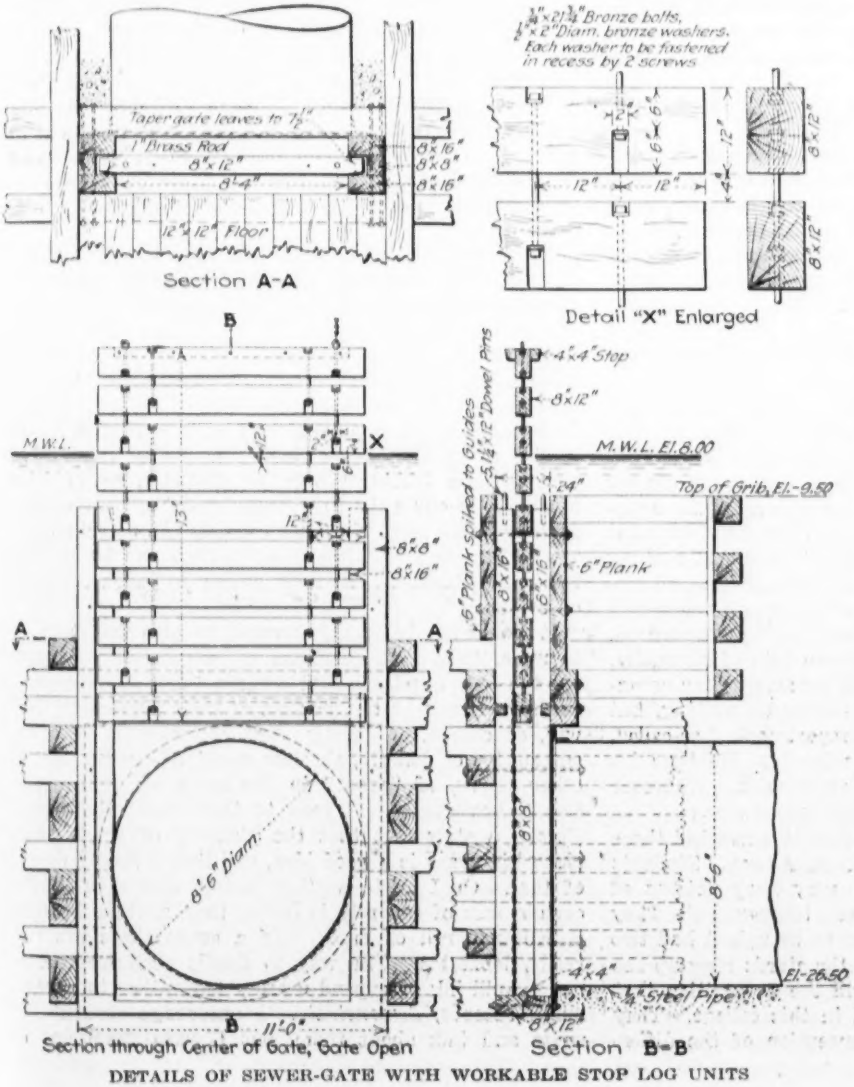
CONCRETE PLANT FOR OUTLET WORKS AT TAYLORSVILLE DAM

Sewer Gate With Articulated Units To Facilitate Moving

Stop Logs Held Together With Bolts in Counterbored Holes—Shutter Openings Reduce Pressure When Gate Is Raised

IN ORDER to avoid, or at least to reduce, the binding commonly met in raising a gate against water pressure, the outfall sewer gate for the Bird Island Pier improvement at Buffalo has been built as an articulated structure.

The gate is made up of 8 x 12-in. timbers laid horizontally to cover the opening, but joined together by bronze bolts in counterbored holes so that when the top timber is lifted the logs will separate successively to the limit of the counterbores thus leaving openings between each log through which the retained water in the sewer can pass. Pressure on the gate is thus relieved and the binding on the guides reduced. Details are shown in the accompanying drawing. The gate was designed for the Department of Public Works in the office of George H. Norton, City Engineer of Buffalo.



DETAILS OF SEWER-GATE WITH WORKABLE STOP LOG UNITS

Chicago to Try Asphaltic Cushion for Street Pavements

TO introduce resilience in street paving, the Board of Local Improvements, of Chicago, has decided to lay sections of creosoted wood block, granite block and brick pavements on a cushion composed of 92 parts of graded lake sand an 8 parts of asphaltic cement having a penetration of about 70. In the opinion of J. G. Gabelman, chief engineer of streets for the Board, the rigid type of pavement with cement-sand cushion will not stand up under the present heavy truck traffic. He considers that the asphaltic-sand cushion will be sufficiently resilient to cushion impact and reduce wear on the surface of the pavement.

This latter cushion, according to John B. Hittell, formerly chief engineer of streets for the Board and now district engineer for the Asphalt Association, will not be as expensive as the 1 to 4 cement mortar cushion and although slightly more expensive than the 2-in. sand cushion previously used under granite blocks, it is believed the resulting benefits will more than compensate for the difference in cost. Mr. Hittell's estimate of the situation follows:

Chicago has many miles of brick, granite and wood-block pavements laid on sand cushions. A large percentage of these pavements are in streets occupied by street car tracks, and as they are not impervious to water, the shifting of the sand bed, due to combined action of traffic, seepage of water and vibration of car tracks has caused the surface of the pavements to be distorted generally by a settlement of that portion adjacent to the rails and a raising of the part along the quarter or gutter. The displacement has not been uniform and has materially reduced the life of the pavements.

To overcome this objection, especially in brick and wood block pavements, the specifications were changed to provide a cushion 1 in. in thickness composed of 1 part of portland cement to 4 parts of torpedo sand or limestone slag screenings. The cement and sand were thoroughly mixed dry and immediately spread upon the concrete foundation, shaping to contour being secured by use of a templet. Immediately before laying the blocks the cushion was wet by means of a rose-head sprinkler with water merely sufficient to dampen the cushion and wet the cement. The result expected from the use of this mortar cushion has not been attained, especially in the case of brick pavements which are deprived of all resiliency and which create considerable noise under traffic. To remedy these difficulties the trial of the asphaltic cushion was decided upon.

The Proof's the Thing!

By Howard Viets
Department of Rhetoric and Public Speaking, University of Minnesota

THE professor of mathematics, who had dropped into my office for a pipe of tobacco, leaned back in his chair, and, as he puffed, ran his eye over the text-books in English that lined the back of my desk. While I was concluding a 'phone call he reached for a text on Argumentation and slowly turned the pages. As I hung up the receiver and turned to him he mumbled from the midst of a cloud of smoke, "I'll wager the boys take to argument. Seems to me a mighty good thing if it will help them to think straight."

"You've said something now," I replied laughing. "Every year since we began to include Argument in our English course I have felt more and more convinced of the wisdom of our decision. It has more than made good."

"Might not be a bad idea to prescribe some for the faculty," my friend rejoined with a quizzical glance at me.

I chuckled as I struck a match, for I felt the tingle that comes with a spirited discussion of a genuinely interesting subject. "You speak about thinking straight," I began. "The very first step in the study of argument is an attempt to straighten out kinks in thinking."

Exposition and Argument

For one thing, most students have no clear conception of the difference between exposition and argument. Somehow, either from text-books or in high school, they become obsessed with the air-tight-compartment view of English—the notion, I mean, that all writing can be sharply set off, segregated, as either Narration, Description, Exposition, or Argument. To them, a certain piece of writing is purely one or another of these "types." It's what you might call the Ivory Soap theory.

Of course such a view is both wrong and pernicious. Consequently it becomes necessary to point out the very close relationship between exposition and argument, to show how any one who has acquired the knack of explaining has in his control the apparatus for arguing; that training in expository writing provides what may be called "mastery of materials," and that a study of argument is really a study of "special uses of materials." Actual specimens of effective argument will show that an arguer employs a great deal of exposition, often with some description or even bits of narrative. The students pretty soon see that an able writer recognizes no air-tight-compartment theory of writing, but reaches over into each of the "compartments," so-called, whenever he finds need of opportunity. He thus increases the number of tools to work with. Whatever may be trumps, he doesn't neglect the bowers.

But when this theory of isolation is unmasked there remains another misconception to clear away. Students have, almost without exception, very hazy notions of the sort of subject that lends itself to argument. They will tackle any subject that looks as though it had two sides. They will argue that the Spaniards blew up the Maine just as readily as they will the proposition that the honor system be established in this college. They apparently have little if any conception of the difference between what are called *questions of fact* and *questions of opinion* or *expediency*. In other words they don't know the distinction between "demonstration" and "proof." They don't realize that there are two ways of "proving" something—two senses in which the word "proof" may be used. It is this sort of loose thinking that tolerates propositions like these: To be solved: that Engineering pays better than Law; that Washington was a greater man than Lincoln; that the horse has been more useful to mankind than the cow. Their study of Geometry, however, enables me to set them right here. I can show them that when they "prove" that the shortest distance between two points is a straight line they are using "prove" in a sense equivalent to "demonstrate" and not equivalent to "prove" as employed in logic. If Einstein's theories continue to gain ground I suppose I shall be forced to find a different theorem for illustration.

Ascertainment of Truth

All this leads quite naturally to a very fundamental matter; namely, that genuine argument is really a balancing, a weighing of pros and cons as though in scale pans—in a word, it is a matter of judgment. A really debatable question will provide arguments on both sides. One scale plan will never be entirely empty. I usually remind them at this point of the expressions used in law: In civil cases one side proves its case "by a fair preponderance of the evidence," and in criminal cases, "beyond a reasonable doubt." They then see how childish it is to write, or say, "I have now conclusively proved," or "Our opponents have failed to show a scrap of evidence" and so on. The role that judgment plays in argument needs, I believe, to be constantly emphasized.

This point is well brought out by John Stuart Mill in one of his addresses, in which he says, "The most incessant occupation of the human intellect throughout life is the ascertainment of truth. We are always needing to know what is actually true about something or other. We all require the ability to judge between the conflicting opinions which are offered to us as vital truths; to choose what doctrines we will receive in the matter of religion, for example; to judge whether we ought to be Tories, Whigs, or Radicals, or to what length it is our duty to go with each." Then a little further on he says, "In what consists the principal and most characteristic difference between one human intellect and another? In their ability to judge correctly of evidence."

It would not be right, however, to give the students to understand that questions of opinion or judgment are the only questions that concern them as engineers-in-the-making. In the practice of their profession they will, of course, constantly meet conundrums that are susceptible of definite, absolute solution—susceptible, in other words, of "proof" in the sense of "demonstration." For example, I read to them from the *News-Record* a statement that the planting of shade trees along highways is a good idea, and then I read a denial of that. Or I quote another writer who says that a certain mix of concrete is better than another because it will not roll or crack. In a sense these are not really debatable. The way to decide such matters is not to spill ink or expend oratory but rather to experiment, observe, *demonstrate*. I encourage students to write and talk about them, but I warn them not to fancy that they are debating, or, strictly speaking,

ever "arguing." They may be "proving" something, but they are proving only in the sense of demonstrating.

Real Proof

After all, this is but preliminary. When they outgrow the air-tight-compartment theory of writing, when they are able to discern what questions are really debatable and what are demonstrable, when they appreciate that true argument is never one-sided, but rather a matter of judgment, the real nut remains to be cracked. This is the matter of evidence, of reasoning—in a word, PROOF. The proof's the thing! As prospective engineers, one of the best things they can possibly acquire from a study of argument is an adequate understanding of what constitutes proof—what real evidence is, what sound, solid reasoning is. And of course in the process of acquiring that understanding they will learn to detect flimsy, incompetent, irrelevant, untrustworthy evidence and its side-partner, fallacious reasoning.

They sadly need this acquirement. There is something really comical in the assurance with which they announce, "I have, therefore, conclusively proved" this or that, when as a matter of fact they have perhaps adduced only a little actual proof, and that, too, often vulnerable. I find that the whole field of proof, in its broadest sense, has to be slowly unraveled for them.

I begin with a text, like any other preacher, and constantly recur to it. This text is—*not winning, but the truth.* How to get at the truth is the nub of our entire study of PROOF.

Mill says in the same address from which I just quoted: "There are but two roads by which truth can be discovered—observation and reasoning. We all observe and we all reason." So we set out with this in mind: That proof—that is, the ascertainment of truth—is made up of facts (got from observation) plus reasoning. Our first precept is: Get your facts right. Learn to observe accurately, to read accurately, to copy accurately, to hear accurately. Without trustworthy facts there can be no sound proof.

As soon as the students appreciate the indispensableness of facts they can proceed to a study of reasoning, the other complementary angle, as it were, of Evidence. It is then easy to show how all evidence can be classified as direct or indirect—as "testimonial" and "circumstantial." The direct or testimonial consists of facts—documents, letters, reports, actual observations, or the "ipso dixit" of recognized experts. The indirect or circumstantial consists always of reasoning.

Of course, it is too much to expect mature, cogent reasoning from most undergraduates, but it is quite feasible to acquaint them with the commonest ways by which men reason and the commonest fallacies into which they are liable to fall. Any educated man surely ought to know what it means to argue in a circle, for example, or to beg the question, or to argue from the part to the whole and so on. Whether a man becomes an engineer or a merchant he will need to know more or less about abstract reasoning. I think it is true, however, apropos of this, that the young engineer will, in point of fact, use the direct form of evidence more than the indirect, facts more than logic.

Almost inevitably some one at about this point in our study of proof raises the question of the relative value of direct and indirect evidence. If no one does, I raise it myself. It is a pertinent inquiry. Off hand, ninety-nine persons out of a hundred will promptly pronounce in favor of direct evidence. Especially is this so in the case of those who have the scientific point of view. Facts, expert testimony, document—you can see the appeal to the scientist. A lawyer, however, will tell you that such a one-sided view is wrong, that as a matter of fact direct evidence is not inherently more trustworthy than indirect, that actually each form has its weaknesses. The outstanding weakness of direct evidence lies in the fallibility of our senses. Tests by psychologists, for example, have shown that rarely do two persons see the same thing in just the same way, or remember things precisely. Our ears often deceive us, so do our eyes and our noses. We make mistakes in copying figures, mistakes in using words that look alike and so on and so forth. The margin of error is surprisingly wide. Lawyers will tell you that the problem of law involved in a given case is nothing compared to the problem of the facts. Establish the facts and the law becomes plain.

You can see now why I make sure that this question is raised. The very act of pointing out the possible weakness of direct evidence emphasizes the need for careful scrutiny of it whenever it is relied upon. It also emphasizes my slogan: The proof's the thing!

I can not see any danger of overdoing that assertion, either. I am reminded of the young lawyer who eagerly handed over five dollars to a wise old attorney on the promise of getting some advice which would be of great value to him during his entire career. This oracular advice was: "Whenever you appear in a case be sure you have plenty of evidence." I'm not inclined to believe that the joke was on the youngster. The platitude he got for his five-spot is one of those commonplaces that can well bear repeating.

Persuasion and Proof

One thing that makes me feel as strongly as I do, that after all the proof's the thing, is the rather common neglect of sound, solid proof—facts and reasoning—for some of the more showy phases of argument, such as style, rhetoric, persuasion. Especially persuasion. So many young writers and debaters want to be persuasive. As though a man, if he be persuasive, eloquent, fiery, could carry the day regardless of sound evidence!

One of the hardest things to do, I find, is to put persuasion in its proper place. The trouble is that not one person in ten knows what persuasion really is. Most people, and especially college boys associate persuasion with eloquence, fire, noise, "pep"—whatever stirs and excites the emotions. One of the aims of a good course in argument should be to set this matter right.

Genuine persuasiveness — lasting persuasiveness — comes from sources too seldom recognized by unthinking people. It can not be slapped on like a coat of paint, nor can it be "created" by "special methods." One can not say "Here I will be persuasive, there I will be convincing." Persuasiveness is just as much at home in a talk or a paper on some engineering topic as in a Fourth of July oration. It is as often quiet as noisy. It comes in a speech or paper as a sort of concomitant of age and experience, of reputation, position, confidence of manner, naturalness of manner, a spirit of fairness. It blends with convincingness. One of the best ways to be persuasive is to forget that you want to be and instead bend all your efforts toward a clear, fair, sound presentation of facts. After all—the proof's the thing!

Plastic Fill Method Cuts Cost of Earth Dike

Water Jets Convert Loosely Deposited Earth Into Stiff Mud Which Flows and Settles Into a Solid Fill

PLASTIC fill was substituted for rolled fill at a reduction in cost in building a cross dam or dike required in constructing the hydraulic fill dam at Taylorsville for the Miami Conservancy District. Into earth which had been deposited by a dragline excavator, water was injected until it became a very stiff dough, sufficiently plastic to flow sluggishly under pressure. By flow and settlement the plastic material was then shaped into an embankment which was impermeable and as firm and solid as could be produced by spreading, wetting, and rolling the earth in thin layers. The plastic fill cost about 50c. a cubic yard compared with about $1 a cubic yard for rolled fill.

At Taylorsville, construction of that part of the main dam lying west of the river was begun first, so that the hydraulic filling might proceed while the river occupied its old channel until the outlet structure on the east bank was completed. For this purpose it was neces-

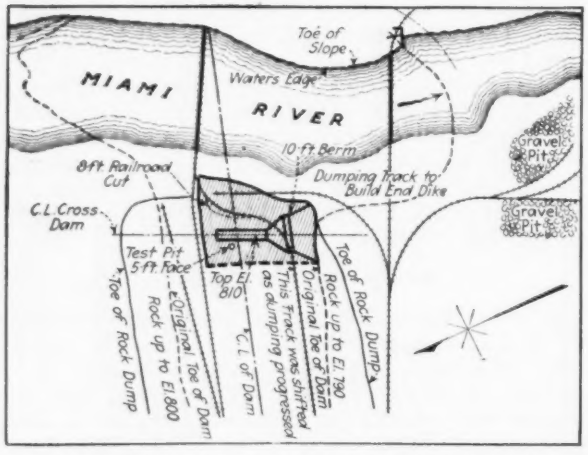


FIG. 1. PLAN OF CROSS DAM AND TRACK LAYOUT

sary to contsruct a cross dam along the west bank of the stream, as indicated by the sketch plan, to enclose the end of the core pool of the hydraulic fill. The volume of the cross embankment was about 45,000 cu.yd., and it was planned to form the fill by spreading and rolling. When about 10,000 cu.yd. had been placed it was decided, on the suggestion of G. L. Albert, superintendent of hydraulic fill, to substitute the plastic-fill method, with which Mr. Albert had had successful results on other embankment construction.

For rolled-fill construction, the material was excavated by a small steam shovel from a borrow pit on the east bank of the river, loaded into 12 cu.yd. cars, transtransported across the river on the downstream trestle, and unloaded by a dragline into a hopper, whence it was hauled in dump wagons to be spread on the fill and rolled. In changing to plastic fill the hopper, dump wagon and roller outfit was removed. In its place there were installed a small pump, pipe, and hose line and two ¾-in. gas pipe nozzles 10. ft. and 5 ft. long. Later the pump was eliminated and water was taken from the monitor pipe line for the hydraulic fill operation.

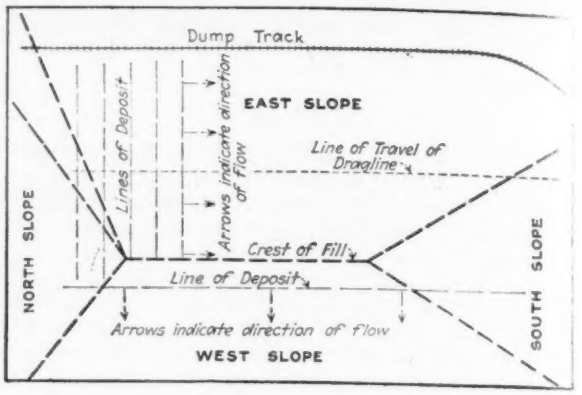


FIG. 2. DIAGRAM OF PLASTIC FILL OPERATIONS

With the dump car track located as shown along the east edge of the cross-dam, the dragline was unable to reach, with its load, to the west edge. Therefore two methods in detail of making the plastic fill were required, one for the fill west of the crest of the dam and another for the remainder of the fill. For both sides the procedure was the same in that dry material was dumped on the ground alongside the dumping track and thence picked up by the dragline and placed in position for the injection process.

When building up the west slope, the dragline laid a windrow of dry material parallel to, but well inside, the west toe of the cross dam. The depth of this pile was about 10 ft. On a line about 2 ft. west of the ridge of the windrow and about 3 ft. apart vertical holes were sunk to the bottom by means of the "jet pipe" and water thus introduced by percolation throughout the depth of the material. As the earth became plastic it would flow and since the water purposely was introduced under the west slope of the windrow the flow was toward the west. By dropping continually fresh material on the windrow, and thus loading the top, and by continuing the injection as circumstances demanded the flow was kept continuous until it reached the slope limits of the cross dam. The greatest distance which the earth was required to move in this manner was 40 ft.

For the remainder of the fill the dragline traveled east and west on the approximate center line of the cross dike, building the material up in a 10-ft. layer by successive north-and-south lines of deposit across the fill. The jetting was done practically as each bucketful was deposited so that the growing edge of the layer was kept plastic and flowing toward the machine. The diagram, Fig. 2, indicates the principle of procedure but does not show the actual methods, which were more or less irregular.

The flow of the plastic fill was slow, not in excess of 3 to 4 ft. a day, and completely under control. At any time the motion could be accelerated by adding to the top load or by injecting more water. It gradually stopped if no load or water was added and it could be checked more quickly by piling dry earth in front of the forward moving edge of the material. When the flowing material had finally settled it was exceptionally dense and stable. The walls of a test pit 5 ft. deep stood vertical. When a cut was made for a service railway an 8-ft. bank stood for a long time at a slope of 1 on ½.

From the experience at Taylorsville and later at the

Englewood dam it is evident that the success of plastic fill will depend upon the character of the earth used. At Taylorsville dam, the material was a glacial till or a mixture of rock ground fine by glacial action and containing a large percentage of clay, the combination being a mixture which would permit the water to escape. The last characteristic, of permitting the water to leak away after it has performed by flow and settlement its task of solidification, is particularly important in an earth to be placed by the plastic fill method. Too fine and retentive a clay, which hangs onto its entrained water, would, it appeared, give trouble if used for plastic fill. This was in fact discovered at Englewood dam, where rolled fill proved to be best.

Taylorsville dam is one of the flood-protection works being constructed by the Miami Conservancy District, Arthur E. Morgan, chief engineer, Charles H. Paul, assistant chief engineer, and C. H. Locher, construction manager. O. N. Floyd is division engineer in charge of the Taylorsville dam operations; H. R. Daubenspeck was in immediate charge of the plastic-fill operations above described.

Function of Technical Schools and Universities

In view of the discussion of engineering education in this country since our entry into the great war, the following editorial from *The Electrician*, London, has special interest:

At the present moment, when scientific and technical education is being much discussed, and plans for their extension are in preparation, it is worth while to consider seriously what the functions of the various institutions, colleges and universities should be, and especially how their activities should dovetail into one another. We perceive a tendency for institutions that are essentially technical schools or colleges to assume almost the functions of a university; and simultaneously we find the older universities, in their zeal for applied science, taking up work that might, perhaps, be more fitly left to technical colleges. There is also a certain inclination towards amalgamation for mere "bigness," which we are not sure is always desirable in an educational institution.

These remarks are suggested by the fact that in Germany the functions of technical schools are now being much discussed. There the so-called "technical school" has, perhaps, reached its greatest development, Charlottenburg being, of course, famous for its size and equipment. We see that Professor Riedler, late professor of enginering at this institution, is dissatisfied with the present methods, and even goes so far as to indicate that a decay set in with the present century, that too much stress is laid on pure technique and encyclopædic knowledge and too little importance attached to general scientific methods and principles. We are inclined to think that this somewhat arid and soulless form of work had become characteristic of many German technical schools before the war. It is, perhaps, a natural consequence of the commercialization of science in a narrow sense, and the modern tendency to "judge by results." We hope that the momentary stress laid on the material results of applied science, necessary as it may be to arouse the interest of the business man, will not go too far in this country. The pure spirit of scientific research, and the uncramped imaginative effort that gives, in the long run, the greatest benefit to humanity, does not thrive in a commercial atmosphere. We hope that this greatest work will be pursued at our leading universities, and that they will not be compelled to adjust their methods to the "payment by results" tendency. Even at those institutions which are admittedly mainly technical, and even industrial, there should be room for the humanizing element in education, and not too much emphasis should be placed on the purely material side of science.

Iowa Methods of Widening and Maintaining Earth Roads

Operations Planned to Build Up Permanent Foundation for Paved Road—Bulk of Work Performed by Tractor-Hauled Graders and Drags

By A. F. Fischer
County Engineer, Johnson County, Iowa

TRACTOR-OPERATED graders and drags are creating the foundation for a paved road system in Iowa at a cost not exceeding that of ordinary earth road maintenance. Neither the drag nor the grader methods are unusual except that each operation is definitely planned to contribute a part toward the upbuilding of a piece of road to receive a permanent surface, as well as to keep that piece of road in the best condition for its present traffic. Broadly speaking, earth road upkeep is made a paved road construction process.

By the method indicated foundation construction is a succession of small operations of simple character. That the sequence of these operations is planned and that each is directed to a definite construction purpose are the facts which give value to a step-by-step recital. Let it be kept in mind, then, that the steps enumerated are units of a construction process which has prepared literally thousands of miles of earth road for hard surfacing at the cost of ordinary earth road maintenance.

As formulated in practice the general plan of earth road improvement in Iowa is: (1) To design a road section which can be machine constructed; (2) to plan a machine outfit and its operation to construct the designed section, and (3) to establish maintenance methods which will continuously preserve and further build up the road.

In the designed cross-section, shown by the accompanying diagram, there is no surface, even the back slopes of the ditches, which cannot be formed by the blade of a grader.

Equipment is standardized as follows: A team outfit works ahead widening narrow cuts and filling in bridge approaches, low places and mudholes. It consists of from eight to twelve teams and an equipment of wheeled, fresno and slip scrapers and small tools. A tractor-operated grader outfit follows the team gang. It consists of two 12-ft. blade graders hauled tandem by a 40-hp. tractor.

For maintenance a combination of patrol outfits, drags and graders is employed, all operations being technically directed as to time, place and procedure.

Tractor Grader Methods

Except at the last, in finishing the crown, the grader operations are duplicated on the two sides of the road. As conditions determine, resort is had to judgment in varying the sequence and the number of grader cuts, but substantially a definite schedule of operations is followed.

Removal of the sod on the outside of the roadway next to the ditch is the purpose of the first cut. The forward grader marks the ditch line but makes no cut, while the rear grader shaves off the sod in a layer about 2 in. thick and 6 ft. wide from the ditch line toward the middle of the road. The thin cut has two objects: (1) It makes it less difficult to hold the grader steady, and (2) it furnishes a thin sod which will not pile up in the succeeding spreading operations. One trip of the grad-

ers completes the sod cutting from the shoulder to the ditch line.

The next operation is to cut the front slope of the ditch to about a foot in depth. Two or three trips of the graders are required for this operation. On each trip the forward grader acts as a cutter and the rear grader as a spreader. In the first trip the forward grader shaves the sod from the front slope of the ditch and carries it onto the shoulder, while the rear grader takes the sod previously cut from the shoulder and distributes it in depressions or lays it in a flat strip next to the center line of the crown. In succeeding cuts the forward grader deepens the ditch while the rear grader spreads the sod. The purpose is to spread the sod and iron it down with the tractor before any loose dirt from the ditch is spread.

When the ditch has been deepened to approximately a foot on the front slope, both graders are brought out of the ditch to distribute the dirt from the ditch cuts. This dirt is spread evenly over the previously placed sod layer. One trip is made with both graders spreading.

Ditch Deepened

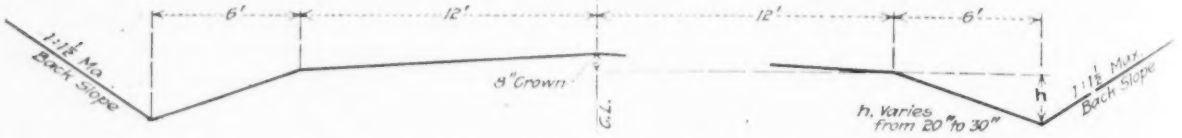
The next operation is to cut the back slope and deepen the ditch. On the first trip the forward girder shaves off the sod in a thin layer for the full width of the slope while the rear grader completes the final spreading trip on the crown. Care is taken to remove all sod from the back slope in this one cut. On the second trip the forward grader is in the ditch, shifting onto the shoulder the sod cut from the back slope, and the rear grader starts taking this sod to the quarter point on the crown. On the third trip the forward grader is on the back slope deepening the cut while the back grader is finally distributing the back slope sod on the quarter point on the crown. The operations described are repeated until the ditch is at the required depth. Each time the front grader runs in the ditch to move away the dirt from the back slope, it also deepens the ditch cut from 4 to 6 in. Usually it requires two trips of the forward grader in the ditch to one trip on the back slope to acquire the planned cross-section. There are intervals in the ditching operation when both graders are taken out of the ditch to spread the excavated material.

Slope Finishing Cut

After the ditch has reached the required depth and the back slope has been properly formed, a final cut on the front slope is made from the shoulder to the bottom of the ditch. This is purely a slope-finishing cut. It does not deepen the ditch but leaves the shoulder in nearly perfect alignment, with a uniform front slope.

Upon completion of the ditch, both graders are used for smoothing the roadway to the planned cross-section. Finally, when the graders have completed a stretch of road, all ditches inaccessible to the graders and all waterways are opened by hand.

Blade graders, road drags and patrolmen's outfits maintain the graded road. The road system is divided into patrol sections varying in length from 8 to 15 mi., and a boss patrolman has charge of each section. Sometimes the patrolman is given helpers. The patrolmen and his helpers are usually hired by the month and furnish their own teams, the county furnishing the tools. Where two men work together, they are given twice as much mileage as that given a signal patrolman. The inclination is to favor the "pair" system because it gives four horses instead of two for light grader work; also when desired, the men can be sent to different locations at the same time. Four-horse graders are preferred to two-horse graders. Good work can be done by either machine, but the four-horse machine, being heavier, does better work, all other factors being equal.



STANDARD ROAD SECTION FOR BLADE GRADER CONSTRUCTION

Contracts are entered into with various individuals, usually farmers living along the road, to do such dragging as cannot be done by the patrolmen. Horse-drawn drags have been used, but the horse is being replaced by the tractor. When using a tractor for power, two drags are hitched abreast or one of the newer forms of patented drags or "maintainers" is used. In order to drag the entire traveled roadway properly, two and sometimes three full round trips are necessary. A stretch of 3 mi. is about all one man can drag, and do the dragging when it should be done, if horsepower is used. If tractor power is used, as many as 12 mi. of road can be properly dragged by one man.

Check Kept on Draggers

The dragmen are at all times under the general supervision of the patrolmen, and they drag the roads in accordance with instructions given them from time to time. Reports of each dragging are sent directly to the engineer's office, where a chart is kept showing the dates of rains, time of dragging, the amount of road dragged by each man. A check is thus kept on the draggers and on the general condition of the dragging which they do.

As soon as the roads permit in the springtime, the tractor-drawn blade graders are sent over the entire mileage. They do not attempt to do any ditching or road building on these initial trips, but merely make a round or two in order to smooth up the traveled roadway by butting off the humps, filling the holes and shaping up the crown. It is best to do this grader work as early as possible because it gives the draggers a good roadway to work on. The same operation with the graders is repeated two or three times during the season, or as often as is necessary to keep the crown in good shape.

In the maintenance of an earth road, dragging at the right time is the big factor in keeping the traveled roadway smooth. Continual dragging tends to "case harden" the roads so that it will take a considerable wet period to damage them seriously during the summer time.

Pontoon Drawbridge and Temporary Girder Swingspan

Bobtail Swingspan Built of Old Girders and Operated by Cable Gear — Replaced by Timber Pontoon Span

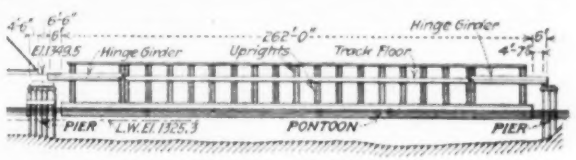
A FLOATING draw span installed in 1919 as part of the new Missouri River bridge of the Chicago, Milwaukee & St. Paul Ry., at Chamberlain, S. D., consists of a single barge or scow carrying a track floor which can be raised and lowered in accordance with changes in the water level of the river. It is similar to other pontoon drawspans used by the same railway for several years (see *Engineering-News* of April 30, 1908, p. 474). This type of pontoon bridge differs from those used in Europe and for military service in that a single large boat lies across the current and forms a floating span, while in the other type a number of small boats anchored parallel with the current form floating piers to support spans laid between them.

In the Chamberlain bridge, the new pontoon is a timber flat-bottom barge 262 ft. long, 40 ft. wide on the deck and 5½ to 6½ ft. deep, as shown in Fig. 1. Its frames are spaced 24 in. c. to c. The planking on the upstream side is protected against ice and drift by $\frac{3}{16}$-in. steel plates held in place by ½-in. carriage bolts spaced 4 in. in both directions.

Two rows of uprights extend along the barge at about 18-ft. spacing. Each is composed of four posts so arranged as to form an opensided member, these posts being seated on stringers laid along the bottom ribs of the frames and secured by through bolts and distance pieces. The uprights extend about 20 ft. above the deck and each is supported laterally by a pair of brace posts seated on a longitudinal timber in the side of the hull. Floor beams for the track system have their ends extending between the posts, which serve as guides. These floor beams are pairs of steel channels, having at each end web filler pieces which give a side bearing against the posts and a bottom cushion which rests on blocking placed longitudinally between the posts. This blocking consists of 8 x 16-in. pieces, 5 ft. long, laid longitudinally between the posts of the upright.

To adjust the track level, the floor beams are raised or lowered by jacks while the blocking is built up or removed correspondingly. The vertical range in elevation is about 16 ft. Upon the floor beams are packed stringers to support the track ties. At each end of the track floor is a hinged girder or apron extending from the pier to the floor beam, these aprons providing for minor differences in elevation between the track on the pontoon and that on the fixed approaches. When the pontoon is moved, the outer end of each apron is raised clear of the pier and supported on a beam between the end and pair of uprights. These aprons have pairs of plate girders, with shelf angles on the webs to support the ends of the ties.

In swinging, the pontoon



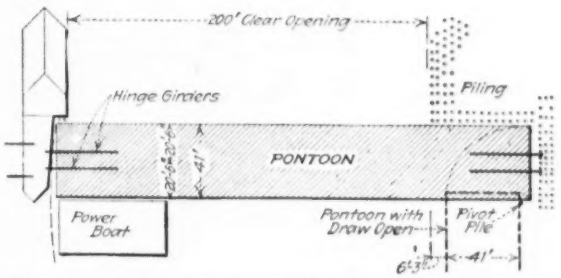


FIG. 2. ARRANGEMENT OF PONTOON AND OPERATING BOAT

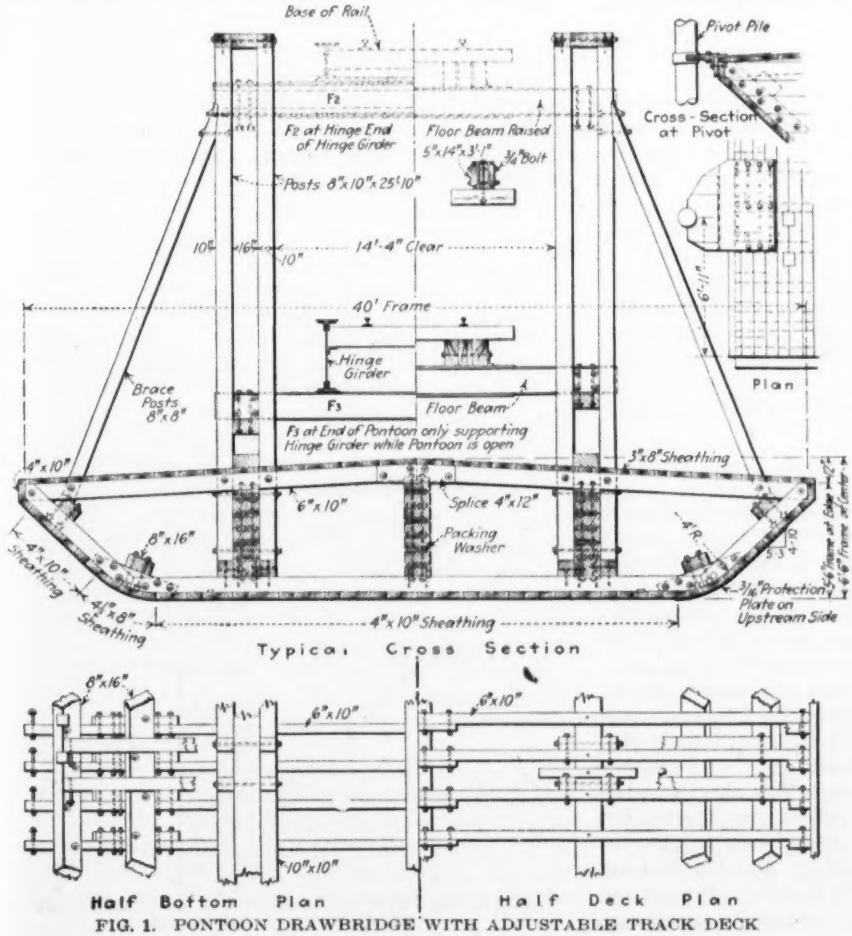


FIG. 1. PONTOON DRAWBRIDGE WITH ADJUSTABLE TRACK DECK

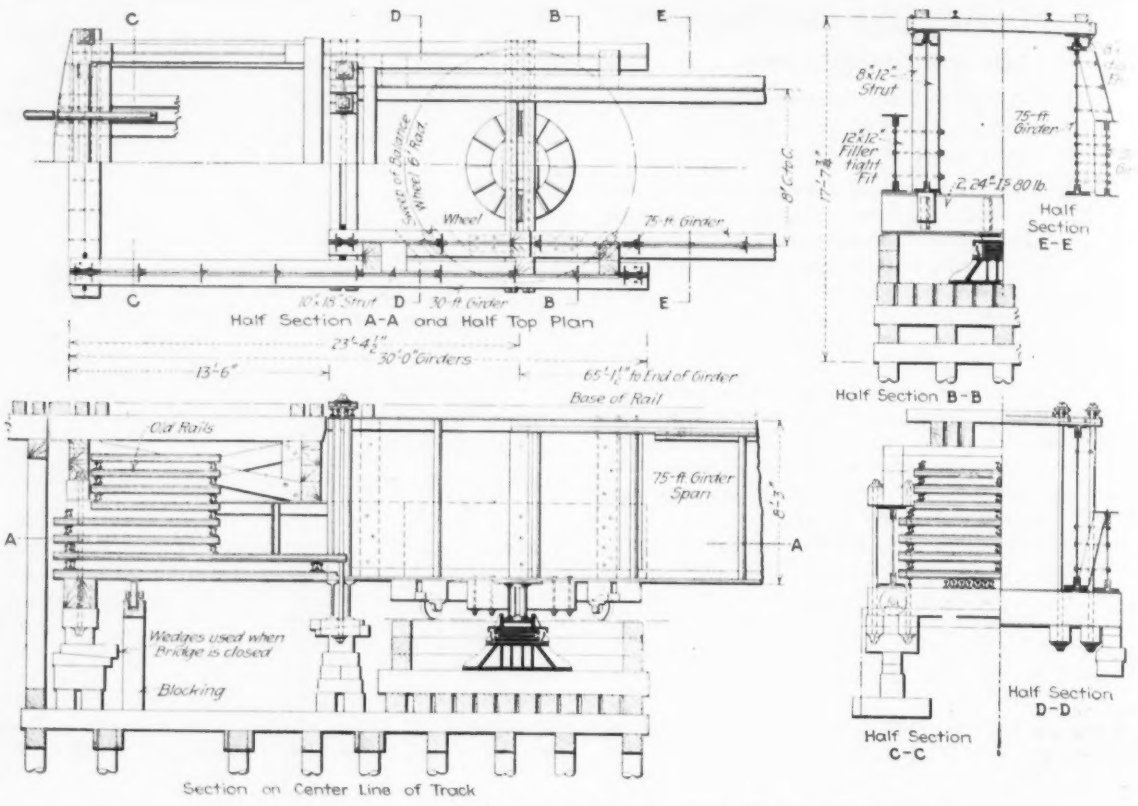


FIG. 3. TEMPORARY SWINGSPAN BUILT OF OLD GIRDERS

revolves about a pivot pile near the end of the downstream side, this pile engaging a semicircular notch in a steel-plate projecting from the deck of the pontoon. When closed, the free end is locked to a pair of anchor piles on the upstream side. For operating the pontoon there is a power boat or small scow lashed to the downstream side of the free end and carrying a hoisting engine. This arrangement is shown in Fig. 2. Over the drum of the engine passes a chain which lies on the bed of the river and is anchored at each end of the draw opening. Horizontal and vertical rollers guide this chain up the side of the scow and pontoon and it is carried across their decks on grooved rollers.

Temporary Girder Swing Span

A 366-ft. pontoon was used originally for the draw at the Chamberlain bridge, but in 1918 this had become so leaky that it could not be kept in service. Pending reconstruction of the bridge and the provision of the new but smaller pontoon described above, a temporary swing span was provided. This was a bobtail plate-girder span built of old material available (Fig. 3.)

Two 75-ft. plate girders formed the main arm and rested upon a bolster at 65-ft. from the free end. Outside of these and projecting 13½ ft. beyond their rear ends were two shallow 30-in. girders carrying a counterweight of old rails piled as shown. This short counterweighted arm was supported by rollers when moving, but with the bridge closed wedges were driven to give the arm a rigid support on the blocking. For the free end of the span the weight was 82,500 lb. for the girders and 17,500 lb. for the track floor, or 100,000 lb. acting at a radius of 31 ft. For the bobtail arm, the weight was 43,900 lb. for girder and floor, with 139,100 lb. of counterweight, making a total of 183,000 lb. acting at a radius of 17 ft.

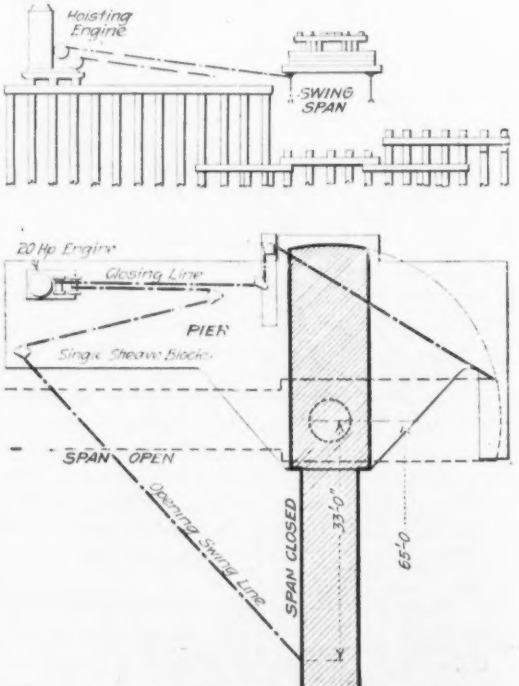


FIG. 4. LAYOUT OF OPERATING MECHANISM OF TEMPORARY SWING SPAN

A bolster or bearing girder composed of a pair of I-beams carried the span and transmitted the load to the upper disk of the center bearing, while four rollers or balance wheels under the girders traveled on a track of 6 ft. radius. At the rest pier, the girders were seated on a pair of rails laid along the bridge seat, the ends of these rails projecting beyond the pier and being curved downward so as to guide and raise the free end of the bridge as it came to the closing position. The end lock was a 3 x 12-in. stick 8 ft. long, laid on the center line between two similar sticks 5 ft. long bolted to the ties on the bridge and the approach.

To Operate Swing Span

To operate this swing span, a 20-hp. double-drum hoisting engine with boiler was installed at one end of the pivot pier, having cables arranged as shown in Fig. 4. The opening line was led from one drum through single-sheave guide blocks and attached to the middle of the main arm of the span, while the closing line was led through similar blocks and attached to the tail end. As the free end of the span reached its closed position, a spring buffer at the side engaged a stop consisting of a pair of heavy timbers bolted to the trestle approach and projecting into the draw opening.

This temporary drawspan and the new pontoon draw were parts of the work of rebuilding the bridge, which work was done by the railway company's forces in 1918-1919 under the general direction of Charles F. Loweth, chief engineer of the Chicago, Milwaukee & St. Paul Railway.

Effect of Electric Locomotives on Track and Wear of Rails

THAT electric locomotives compare favorably with steam locomotives in their effect upon the track is the experience of the Chicago, Milwaukee & St. Paul Ry., according to the report presented by the committee on electricity at the annual meeting of the American Railway Engineering Association.

In the opinion of roadmasters and superintendents on the electrified zone there is no greater slipping of the locomotive wheels on the rail and consequently no greater damage to the top of the rail under electric operation than there is under steam operation. It has not been found that there is any greater tendency for the rails to creep on account of regenerative braking on descending grades than there was under the braking action of steam locomotives. No case has been found in which electric locomotives moving at a high rate of speed have tended to displace the rail on the ties or the ties in the ballast.

Roadmasters agree that electric locomotives are easier on the track than steam locomotives because of the less rigid construction. It is stated that the flange wear on curves under electric operation is actually less than under steam operation, for the reason that the electric locomotives are less rigid in their wheel arrangement.

On curves the outer rails are elevated for speeds of 30 m.p.h. on mountain grades and 45 m.p.h. for valley territories. On the Rocky Mountain and Missoula divisions the mountain grade superelevation is ½-in. per degree of curvature with a maximum of 3 in. On other curves the superelevation is 1 inch per degree with a maximum of 3½ inches.

Notes from Foreign Fields

BRITISH ROADS FOR HEAVY TRAFFIC

BY

E. J. Mehren

EDITOR ENGINEERING NEWS-RECORD

IN A previous letter (see *Engineering News-Record*, June 24, p. 1267) I raised questions whether waterbound macadam in England stands up under motor-truck traffic and, if so, why.

These questions I am in a position now to answer in a single statement:

Waterbound macadam here, as in the United States, *does not stand up under motor-truck traffic.*

The maintenance costs are excessive, and as rapidly as possible waterbound macadam on heavily-traveled routes is being replaced with some form of tar or asphaltic construction. In fact, a very large mileage of the main roads has already been so reconstructed, and had been even before the war.

To the American observer the universal adoption here of the bituminous road occasions surprise. We are accustomed to thinking of concrete and brick as being, with bituminous pavements, the standard types of construction for heavy traffic. Never once have I heard the concrete road proposed as a solution of the British road problem, but when I have brought up the subject a lively interest has been shown. The concrete road, however, is distinctly out of the reckoning here. Brick is even less in mind.

Moreover—and this must have special emphasis—the bituminous pavements *are not laid on a concrete base*, but on the old macadam.

The reasons for these practices are not difficult to find. First, however, regarding the non-use of a concrete base. Compared with our own, the road system of England is quite mature. In addition, long tenure of office has resulted in standardizing practice in highway construction. A county surveyor does not rush out of office the very year he begins experimentation. He stays on and benefits by his failures and successes. As a result a sound body of practice has been built up, and by constantly sharing experiences—rather easy to do in a country as small as Britain—practices have tended to standardize.

This shows itself, for example, in the extremely important matter of drainage. So much do they consider adequate drainage a necessary condition of good roads that no one has mentioned the subject to me. I have always had to bring it up, and then have been met by the rejoinder, "Of course, you can't do anything unless your roadbed is kept dry." And dry they do keep it—not by any mysterious means, but by ditches and longitudinal tile, with herringbone drains when conditions demand them. For two genrations, under intelligent supervision, the wet spots have been systematically eliminated, so that the drainage job, as a construction feature, may now be said to be done. The ditches, drains and culverts are well looked after, so that they continue to function properly.

It follows, therefore, that a solid roadbed having been secured and the metalling having been consolidated by years of traffic, the old waterbound macadam pavement is a very excellent base for the tar-macadam or asphaltic top. British expectations regarding this construction have been fully realized and the thousands of miles of it in use show that for conditions here a concrete base is not required.

Of course, one can foresee traffic conditions that will lead to more expensive construction. In Lancashire, for example, the county surveyor, Mr. W. H. Schofield, has long since found it economical to lay granite-block pavement, both with and without concrete base, on the roads between the great industrial cities in the south of the county, in the Liverpool-Manchester area. These roads carry as much as 10,000 long tons of motor-truck traffic per day.

So much for the none-use of the concrete base.

Slight Interest in Concrete Roads

As for the relatively slight interest in the concrete road, there are a number of reasons. They may be summarized as follows:

1. Experimental sections laid here have not been successful. The reasons for failure I have not been able satisfactorily to learn.

2. British engineers insist upon proceeding cautiously. Their traditions and their outstanding success in road work fully justify them in knowing whither they are going before they start on large outlays.

3. There is quite general doubt as to the satisfactory qualities of concrete as a wearing surface. This may be due, in part, to the failures of the experimental sections, but probably more largely to a partiality, fully warranted by their experiences, for the bituminous surface.

4. Tar macadam was cheap before the war, costing from 3s. 6d. to 4s. per square yard (from about 85 to 96 cents per square yard), including the scarifying, reshaping and rolling of the old macadam base. With the excellent foundation afforded by the old macadam there was no reason for laying a more expensive pavement—and more expensive concrete would have been.

5. For six years any new thinking in engineering work has been stopped. Interest was shown in concrete roads in 1914 and there might have been a change in sentiment had there been, since then, six years of road study and experimentation instead of war and its aftermath. In our own country the great strides in the popularity of concrete have been made in these six years.

6. There is doubt whether, in the long run, concrete will prove to be cheaper than other pavements. British engineers listen attentively when I tell them that our maintenance costs for the pavement itself are less than $100 per mile per year for an 18-ft. width. That figure impresses them, but they advert to the relatively short period of our experience—say, 7 to 8 years—and ask what it will be after 15 years, when we may have had to put on a bituminous topping.

7. Finally, there is an objection that we in the States would never dream to be serious—the shutting off of traffic while the concrete cures. Here again we must understand British conditions. Detouring is, of course, possible, but the parallel system of roads, so common with us, is unknown here. The length of detours, compared with the length of road closed, would be much greater than with us. Apparently, too, the British public is more likely than ours to protest against inconveniences. When I first heard this objection I found it difficult to accept it as serious, but confirmation of the original statement by various road authorities convinced me that it is an important factor in eliminating the concrete road.

These are the principal reasons, as I find them, why concrete is not used here. It is admitted, though, that with the great rise in price of tar and pitch (the price of Portland cement has not risen in equal proportion) much more thought will be given to the use of concrete. Our success with it is known here, and commends for concrete respect and consideration it might otherwise not get.

Bituminous Construction

As to bituminous construction, there are a number of types in use. Tar and pitch are used to a very much greater extent than asphalt, though here again a change appears impending, due to price considerations. Asphalt has always been the dearer product, but tar and pitch are now so expensive that asphalt cannot compete on a price basis. (I take asphalt here in the sense used in the United States. When the British engineer uses the term "asphalte," without qualification, he means rock asphalt—a material used here only for city paving.)

Tar-macadam is, from my observation, the favorite type, using blast-furnace slag as an aggregate where obtainable. Granites and andesites are also used for aggregate, though the general experience here is that they do not give as good results as slag. The latter has little or no free sulphur in it, and carries from 30 to 40 per cent of lime. Practice varies as to thickness—from 3 to 4½ in.—but universally it is laid in two courses, a 2 or 2½-in. stone for the bottom course and 1½-in. stone for the top. The stone is coated hot at the quarry or at a central plant, then shipped to the job and laid cold. After the two courses are down the surface is sealed with tar (about ⅛ or ¼ gal. per yard) and the top covered with ⅜-in. granite chips. These roads as a rule are given a tar-spraying annually, at a pre-war cost of about 2½d. (about 5 cents) per yard. This would give an annual spraying cost, for an 18-ft. road, of about $500 per mile, and for the first 8 to 10 years this is the only maintenance cost.

The penetration type is also used. It is here called "pitch grouting." I had the pleasure of going over the truly remarkable highway system of Midlothian County, Scotland, where the county surveyor, Mr. W. H. Ellacott, has used the penetration method extensively and successfully. It is done much after the methods we use in the United States, the grouting material being pitch (the residuum from coal-tar distillation) fluxed with creosote oil. At Liverpool, the city engineer, Mr. John A. Brodie, has also used the penetration method successfully. He showed me many miles of it carrying, as it does in Mr. Ellacott's county, heavy traffic. Some of it has been down 20 years, with very little maintenance. One street had been laid 14 years with *not a single spraying*. It was still in fine condition. Mr. Ellacott sprays even his grouted roads every year, though often only the center needs the annual treatment.

In his pitch grout Mr. Brodie uses 50 per cent fine sand, with which some lime is mixed to increase the percentage of fine material.

Always where roads are sprayed a surfacing of granite chips is used, thus putting on annually a new wear-

ing surface of, say, ½ to ¾ in., beside sealing the surface.

While these types are the ones generally in use, a two-course bituminous pavement with an asphaltic wearing surface is coming into favor and is the concrete road's direct competitor for heavy traffic. This type consists of a pitch-penetration or a tar-macadam lower course laid to a consolidated thickness of 3 in. (using 2-in. stone). On this course is laid a 1½-in. asphalt wearing surface, similar in composition to our wearing surfaces for sheet-asphalt pavements. The cost of this type of work (which like all bituminous paving on country roads is laid on the old macadam pavement as a base) is now about 17s. per square ward, while concrete, 6 in. thick, would cost from 18s. 6d. to £1 per square yard. The reason that this two-course work is coming into favor is that for 2 or 3 years it requires no maintenance whatever, while the maintenance cost is very small for the first 8 or 9 years. It was freely predicted to me that this type will come into very rapid favor. This view was endorsed by Mr. J. S. Killick, chief engineer of the Roads Department of the Ministry of Transport, who regarded it as the coming popular type for main roads except those of extremely heavy traffic.

This subject, I find, is taking more space for its treatment than I had anticipated and since I still have two especially important points to bring out regarding road practice in Great Britain I will defer their treatment to the next letter, rather than, by putting them last, to allow it to appear that they are relatively unimportant.

Liverpool, June 2.

FURTHER HIGHWAY OBSERVATIONS IN GREAT BRITAIN

MY LAST letter closed with the statement that I had two observations of some importance to make regarding highway practice of Great Britain. One relates to the construction of any road over clay and the other to the need for abutments for bituminous road crusts. Both subjects are viewed here with remarkable unanimity and, I believe, in a way new to us in the United States.

It is the universal practice here to cover the clay subgrades with 3 to 4 in. (after rolling) of cinders or ashes. It is the generally prescribed remedy for preventing clay working up into the stone. Gravel is used if ashes or cinders are not available, but the agreement is general that gravel is not as good as either of the other materials. The common description of the effect of the cinders is that they "smother" the clay. I drove over a road near Blackpool constructed over very wet ground, and the county surveyor informed me that he felt it wise at this place to use 12 in. of cinders.

Any kind of ash or cinders apparently will do—from stove-ashes to steam cinders and destructor clinker. It seems worth while to place special emphasis on this practice, for the boiling up of clay into plain macadam and surface-treated macadam tops is a common difficulty with us. In some of our states a layer of gravel is used on top of clay but the universal view here that cinders are better should induce experimentation with them in the States.

Be it noted, too, that the cinders are put down even when a Telford base or "pitching," as they call it here, is used. The cinders cover the clay and the Telford goes on top of the cinders.

The second point that I wish to emphasize is that there is general agreement here that bituminous surfaces—laid, of course, on a macadam base—require abutments on both sides to prevent the surface pushing outward. Mr. A. Dryland, the county engineer of Middlesex, stated that he had found tar crusts pushed 18 in. under the sod shoulder. The type of abutment used is a curb, sometimes of sod, but preferably of stone. I have seen miles of stone curbing along the more heavily-traveled country roads, the purpose being twofold—to furnish the abutment, or shoulder here referred to and to prevent the cutting into the sod shoulder which would otherwise occur. Incidentally, the drivers run their wheels against the curbs on down grades and use them as brakes.

It should be remembered, as I pointed out in an earlier letter, that shoulders as we know them—extensions of the road surface, but of a cheaper material—are not used here. The word "shoulder" here means a raised margin, or curb, at the edge of the metalled way.

Obviously the sod shoulder does not furnish as much support as is desirable, yet it is of some value, particularly when backed by a gravel footpath.

So far as I know we have not given this matter of abutments as much consideration as they have here. British engineers consider it an essential feature of good bituminous construction.

FOOTPATHS

Reference has been made several times in this correspondence to the practice of providing footpaths on country roads. These paths are generally of gravel, but it is beginning to be the practice to tar-treat them. There are many miles of such tar-treated footpaths in two of the counties whose roads I inspected, Midlothian and Lancashire. In Midlothian ¼ to ½-in. stone is used, and sprayers 3 ft. wide have been developed to cheapen the work. Spraying in alternate years is sufficient to keep the paths in good condition.

This construction and maintenance of footpaths is but one of the many evidences of a development far beyond our own. We are coming, of course, to greater refinements—and among those refinements maintained footpaths will be the earliest. It is highly uncomfortable and even dangerous now to walk on the highways near the big cities. Before long some one will "break the ice" by building footpaths; their acceptance after that is likely to be rapid.

Liverpool, June 2.

Zoning Commission at Philadelphia

In accordance with a provision of the new city charter, the Mayor of Philadelphia recently created a zoning commission of 18 members. Seven of the members are heads of municipal departments and bureaus, nine represent various organizations in the city, and two members are unattached. Among the department or bureau heads are George S. Webster, chief of the Bureau of Surveys; John A. Vogelson, chief of the Bureau of Health, and John P. B. Sinkler, city architect. etThe Philadelphia Engineers Club is represented by Walter F. Ballinger, and the Amercan Institute of Architects by Edgar V. Seeler, Philadelphia chapter. The Master Builders' Exchange and the Central Labor Union each has a representative on the commission.

Table Simplifies Use of Templates In Track Plotting

By J. G. Walsh
Chief Field Engineer, T. C. I. & R.R. Co., Ensley, Ala.

THE accompanying table was prepared to simplify the use of drafting curves, or templates, in plotting track layouts. Templates in common use for such work are practically all designed to be used on maps of 1 in. to 100 ft. scale.

My experience has been that in the use of other scales, such as 20 ft., 30 ft. or 40 ft. to the inch, reduction of the curve by calculation, though very simple, entails a certain loss of time as well as probability of errors in calculation, which I have found amounts to about 15 per cent of loss in a day's work.

In using this table the draftsman desiring to plot an 8 deg. scale will find his curve indicated in the column headed "1 in. = 30 ft." opposite "8°" column headed "D. C." (Degree of Curve), and it will be found to be a 2°24′ curve of radius, 2387.5 ft. Therefore if his templates have been marked according to the curve degrees he will select the one nearest to 2°24′. This would be the one marked 2°30′ as they generally are marked by even quarters of a degree. If his templates or curves are marked by a certain number of given inches to the radius he will select the template or curve marked 24. The number 24 indicates that it is cut on a 24-in. radius, which on a scale of 100-ft. to the inch would be a 2400-ft. radius, being the nearest distance to the 2387.5-ft. radius given in the table. This is close enough for all practical purposes in plotting track work.

Templates or curves marked to indicate the number of inches to the radius are not used very extensively by engineers in plotting track-work; the explanation of the use of the table in connection with the te plates marked this way is for the benefit of draf men who have a varied class of work, perhaps incl ing pipe work, as is the case in our engineering partment. In my department we use the curves mark with degrees; in the drafting room they use the radi of the templates marked in inches.

Driest Season at Panama

Gatun Lake in the Panama Canal was at its lowes recorded minimum level during the past season. That season, beginning about the middle of December, 1919, and ending on May 13, 1920, was the driest since the American occupation of the Canal Zone. The average precipitation recorded at twelve stations on the isthmus was 3.93 in. as against 5.37 in. in the season of 1911-12, the previous dry record. The scanty rainfall resulted in lowering the surface of Gatun Lake to 81.76 ft. above sea level, the lowest on record. This occurred on May 28, after rains had begun but before the runoff drainage basin had increased. The storage depletion of the lake represented in the drop of 5.24 ft. from the 87-ft. level at which the dry season began amounted to 20.46 million cu.ft. On March 3 the water consumption of the hydro-electric station was reduced and about 50 per cent of the load carried by the steam generating plant at Miraflores until June 3. It is stated that a surface elevation of 79 ft. has been considered as giving ample depth for navigation through the completed canal. Had the proposed Alhajuela Lake of 15 billion cu.ft. capacity been built there would have been available this year for replenishing the Gatun Lake storage depletion a somewhat larger flow, but due to the very low rainfall the lake elevation would not have been so very much higher than it actually was.

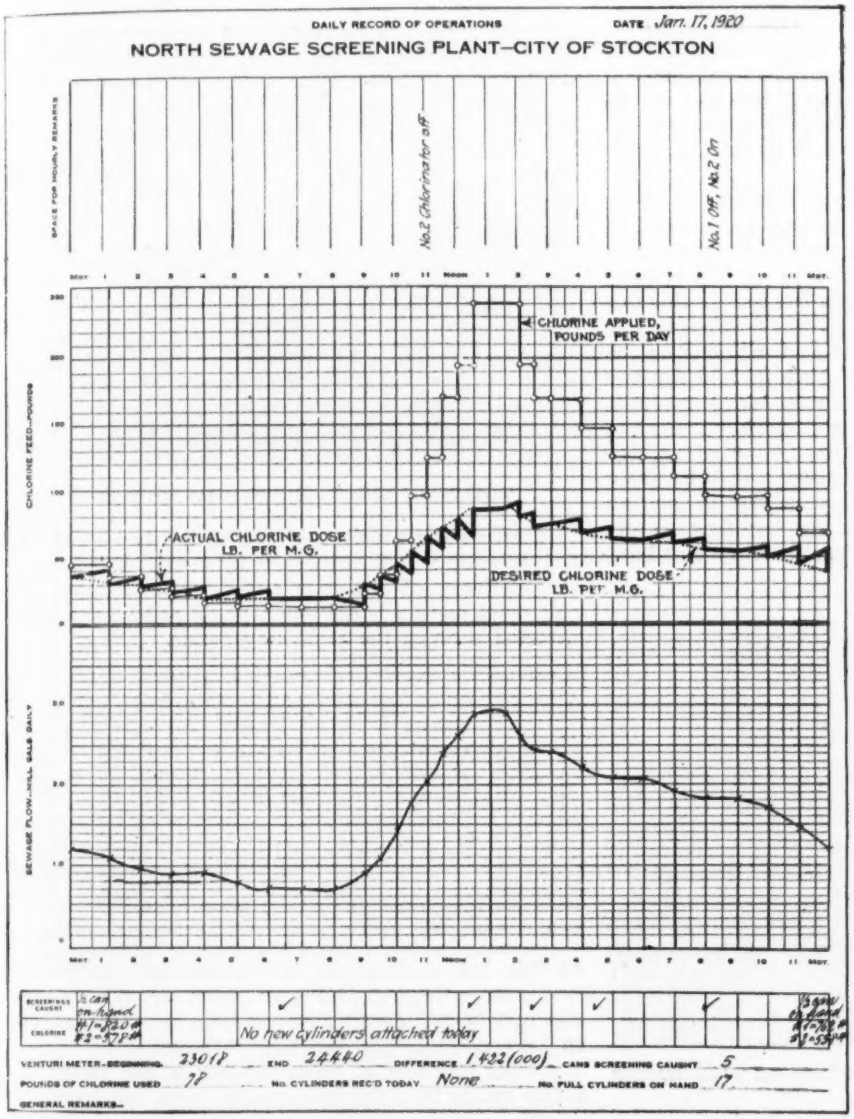
COMPARATIVE TABLE OF RADII AND DEGREE OF CURVE, FOR CURVES MARKED 1 IN. = 100 FT. SCALE

No. C.	1 In. = 100 Ft.		1 In. = 60 Ft.		1 In. = 50 Ft.		1 In. = 40 Ft.		1 In. = 30 Ft.		1 In. = 20 Ft.		1 In. = 10 Ft.	
	D.C.	R.	D.C.	R.	D.C.	R.	D.C.	R.	D.C.	R.	D.C.	R.	D.C.	R.
Deg.	Deg.		Deg. Min.	Ft.	Deg. Min.	Ft.	Deg. Min.	Ft.	Deg. Min.	Ft.	Deg. Min.	Ft.	Deg. Min.	Ft.
1	1	5,729.6	0 36	9,549.3	0 30	11,459.2	0 24	14,323.6	0 18	19,098.6	0 12	28,647.8	0 06	57,295.8
2	2	2,864.9	1 12	4,774.7	1 0	5,729.6	0 48	7,162.0	0 36	9,549.3	0 24	14,323.6	0 12	28,647.8
3	3	1,910.0	1 48	3,183.2	1 30	3,819.8	1 12	4,774.7	0 54	6,366.3	0 36	9,549.3	0 18	19,098.6
4	4	1,432.6	2 24	2,387.5	2 0	2,864.9	1 36	3,581.1	1 12	4,774.7	0 48	7,162.0	0 24	14,323.6
5	5	1,146.3	3 0	1,910.1	2 30	2,292.0	2 0	2,864.9	1 30	3,819.8	1 0	5,729.6	0 30	11,459.2
6	6	955.4	3 36	1,591.8	3 0	1,910.1	2 24	2,387.5	1 48	3,183.2	1 12	4,774.7	0 36	9,549.3
7	7	819.0	4 12	1,364.5	3 30	1,637.3	2 48	2,046.5	2 06	2,728.5	1 24	4,092.7	0 42	8,185.2
8	8	716.7	4 48	1,194.0	4 0	1,432.7	3 12	1,790.7	2 24	2,387.5	1 36	3,581.1	0 48	7,162.0
9	9	637.3	5 24	1,061.4	4 30	1,273.6	3 36	1,591.8	2 42	2,122.3	1 48	3,183.2	0 54	6,366.3
10	10	573.6	6 0	955.4	5 0	1,146.3	4 0	1,432.6	3 0	1,910.1	2 0	2,864.9	1 0	5,729.6
11	11	521.6	6 36	868.6	5 30	1,042.1	4 24	1,302.5	3 18	1,736.5	2 12	2,604.5	1 06	5,208.8
12	12	478.3	7 12	796.3	6 0	955.4	4 48	1,194.0	3 36	1,591.8	2 24	2,387.5	1 12	4,774.7
13	13	441.6	7 48	735.1	6 30	881.9	5 12	1,102.2	3 54	1,469.4	2 36	2,203.9	1 18	4,407.5
14	14	410.3	8 24	682.7	7 0	819.0	5 36	1,023.6	4 12	1,364.5	2 48	2,046.5	1 24	4,092.7
15	15	383.1	9 0	637.3	7 30	764.7	6 0	955.4	4 30	1,273.6	3 0	1,910.1	1 30	3,819.8
16	16	359.3	9 36	597.5	8 0	716.8	6 24	895.7	4 48	1,194.0	3 12	1,790.7	1 36	3,581.1
17	17	338.3	10 12	562.4	8 30	674.7	6 48	843.1	5 06	1,123.8	3 24	1,685.4	1 42	3,370.5
18	18	319.6	10 48	531.3	9 0	637.3	7 12	796.3	5 24	1,061.4	3 36	1,591.8	1 48	3,183.7
19	19	302.9	11 24	503.4	9 30	603.8	7 36	754.4	5 42	1,005.6	3 48	1,508.1	1 54	3,015.7
20	20	287.9	12 0	478.3	10 0	573.7	8 0	716.7	6 0	955.4	4 0	1,432.7	2 0	2,864.9
21	21	274.4	12 36	455.6	10 30	546.4	8 24	682.7	6 18	909.5	4 12	1,364.5	2 06	2,728.5
22	22	262.0	13 12	435.0	11 0	521.7	8 48	651.7	6 36	868.6	4 24	1,302.5	2 12	2,604.5
23	23	250.8	13 48	416.2	11 30	499.1	9 12	623.5	6 54	830.8	4 36	1,246.0	2 18	2,491.3
24	24	240.5	14 24	398.9	12 0	478.3	9 36	597.5	7 12	796.3	4 48	1,194.0	2 24	2,387.5
25	25	231.0	15 0	383.1	12 30	459.3	10 0	573.6	7 30	764.5	5 0	1,146.3	2 30	2,292.0
26	26	222.3	15 36	368.4	13 0	441.7	10 24	551.7	7 48	735.1	5 12	1,102.2	2 36	2,203.9
27	27	214.2	16 12	354.9	13 30	425.4	10 48	531.3	8 06	707.9	5 24	1,061.4	2 42	2,122.3
28	28	206.7	16 48	342.3	14 0	410.3	11 12	512.4	8 24	682.7	5 36	1,023.6	2 48	2,046.5
29	29	199.7	17 24	330.6	14 30	396.2	11 36	494.8	8 42	659.2	5 48	988.3	2 54	1,975.9
30	30	193.2	18 0	319.6	15 0	383.1	12 0	478.3	9 0	637.3	6 0	955.4	3 0	1,910.1
31	31	187.1	18 36	309.4	15 30	370.8	12 24	463.0	9 18	616.8	6 12	924.6	3 06	1,848.5
32	32	181.4	19 12	299.8	16 0	359.3	12 48	448.6	9 36	597.5	6 24	895.7	3 12	1,790.7
33	33	176.1	19 48	290.8	16 30	348.5	13 12	435.0	9 54	579.5	6 36	868.6	3 18	1,736.5
34	34	171.1	20 24	283.3	17 0	338.3	13 36	422.3	10 12	562.4	6 48	843.1	3 24	1,685.4
35	35	166.4	21 0	274.4	17 30	328.7	14 0	410.3	10 30	546.4	7 0	819.0	3 30	1,637.3
36	36	161.9	21 36	266.0	18 0	319.6	14 24	398.9	10 48	531.3	7 12	796.3	3 36	1,591.8
37	37	157.6	22 12	258.1	18 30	311.1	14 48	388.2	11 06	517.0	7 24	774.8	3 42	1,548.8
38	38	153.7	22 48	252.9	19 0	302.9	15 12	378.1	11 24	503.4	7 36	754.4	3 48	1,508.1
39	39	149.8	23 24	246.6	19 30	295.2	15 36	368.4	11 42	490.6	7 48	735.1	3 54	1,469.4
40	40	146.2	24 0	240.5	20 0	287.9	16 0	359.3	12 0	478.3	8 0	716.8	4 0	1,432.7

Graphical Records of Sewage Flow and Chlorine Dosage

TO get a daily report which can be quickly reviewed and a closer approach to the true conditions than is afforded by the usual method of recording operations at a Riensch-Wurl sewage screening plant, the City of Stockton, Cal., is using a graphical record chart on which sewage flow, chlorine dosage and other data are recorded.

In devising a chart that would accomplish this purpose, C. G. Gillespie, then director of the Bureau of Sanitary Engineering of the State Board of Health, said: "Readings in such a plant can seldom be made on schedule, nor can the series of readings to be taken together at one time always be so made. Yet for the sake of economizing on space on his record sheet, the operator will seldom enter the time of readings more closely than to the nearest hour. All sorts of fluctuations, however, may have occurred between the time the reading was taken and the time it is recorded as having been taken."


DAILY RECORD OF OPERATIONS
DATE Jan. 17, 1920
NORTH SEWAGE SCREENING PLANT—CITY OF STOCKTON
SPACE FOR HOURLY REMARKS
No.2 Chlorinator off
No.1 Off, No.2 On
CHLORINE APPLIED, POUNDS PER DAY
ACTUAL CHLORINE DOSE LB. PER M.G.
DESIRED CHLORINE DOSE LB. PER M.G.
CHLORINE FEED—POUNDS
SEWAGE FLOW—MILL SALE DAILY
SCREENINGS CAUGHT
CHLORINE
No new cylinders attached today
VENTURI METER—BEGINNING 23018 END 24440 DIFFERENCE 1.422(000) CANS SCREENING CAUGHT 5
POUNDS OF CHLORINE USED 72 NO. CYLINDERS REC'D TODAY None NO. FULL CYLINDERS ON HAND 17
GENERAL REMARKS—

At the Stockton plant sewage flows to the works by gravity and after screening is chlorinated as it enters a sump from which it is pumped into the San Joaquin River. The sewage flow is measured by noting the rate of rise of the sewage in the sump, usually ranging about 1 ft. a minute, and taking the corresponding flow from a chart which shows the relation between rate of rise in the sump and daily rate of flow. The chlorine is applied through two Wallace & Tiernan manually controlled chlorinators, to each of which are attached several cylinders setting on scales.

To gage the chlorine feed the sewage flow is measured hourly or oftener, depending on the fluctuation, and the chlorine feed changed accordingly. The purpose is to use a dose which will afford a safe degree of disinfection as determined by the State Board of Health. To accomplish this the dose must be varied with the strength of the sewage and the rate of sewage flow.

The chart is composed of two main sections, one for recording the sewage flow and the other the chlorine data. Miscellaneous information is also noted at less frequent intervals. Sewage flows are charted as a dot and a smooth line backward to the previous dot. The inclination of this line enables the operator to predict fairly well the flow he should be prepared to dose in the next half hour or so. The entire line gives a regimen of sewage flow for that day.

On the upper half of the chart three lines are charted after much the same idea. First, the "desired" chlorine dose is entered. The figure for this is given by the State Board of Health, and taken as a function of the sewage flow. The chlorine feed as measured at the chlorinators is then read and charted. From this the "actual" dose is calculated and charted. If it departs materially from the "desired" dose line the chlorine feed is changed by hand, this fact being indicated by a step in the chlorine feed line. The time of the change is likewise shown to within the nearest five minutes. One copy of the chart is sent to the State Board of Health daily.

City Planning Commission at Davenport, Ia.

A city planning commission was recently created by ordinance at Davenport, Ia. It consists of 12 citizens and the Mayor and City Attorney serving as ex officio. The commission will act in an advisory capacity and will take up zoning.

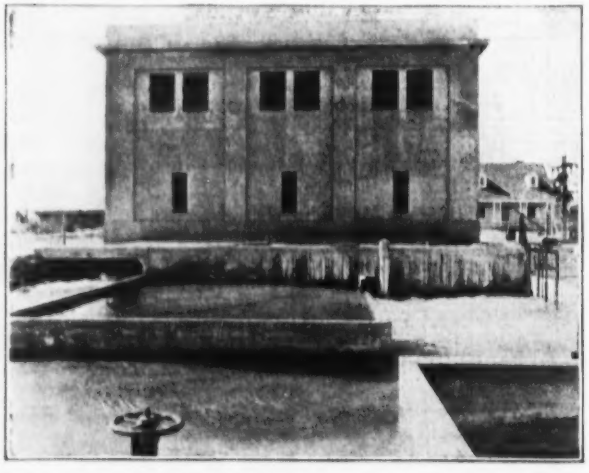
Impulse Turbines Utilize Wide Range of Head and Flow

Small Plant at Fontana, California, Loses Only 3 Per Cent Efficiency When Flow Falls Off 83 Per Cent

AT FONTANA, Cal., the scope of an irrigation project was recently extended to include the development of water power when it was found that a favorable contract could be made with the local power company. The conditions imposed on the plant by the irrigation requirements vary the effective head 30 per cent and the flow 83 per cent. With the hydraulic impulse turbines which were designed to meet these conditions it has been found possible to operate at minimum flow with a loss of only 3 per cent in the efficiency attained at maximum flow. This has made it profitable to utilize the power even under the disadvantage of the wide variation.

Only a limited area in the mountains was available as a source of water supply, and as a protection against dry years the supply had to be carefully conserved in a storage reservoir. The topography of the country required a pipe line nearly 6 mi. in length. In this distance a total gross head of 725 ft. was developed.

The agreement with the power company was on the basis of a flat rate per kilowatt-hour to hold for any amount of power delivered. These terms made it desirable to develop all the power possible, but against this had to be balanced the necessity for water conservation. In other words, irrigation had to be given precedence and the problem became one of getting the maximum power from the varying flow as determined by irrigation needs. The quantity and head

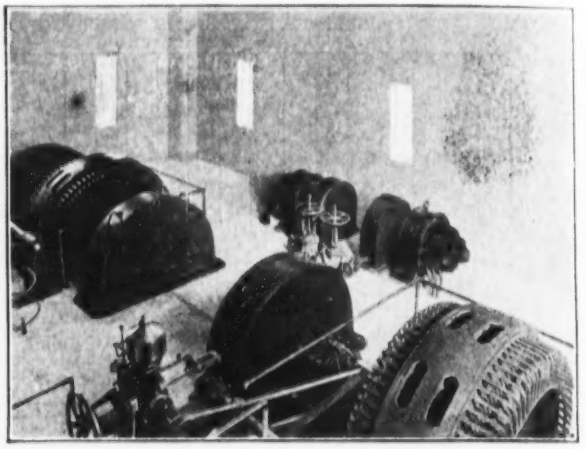


WEIRS AT FONTANA PLANT TO MEASURE TAIL WATER

ranged from a maximum of 58 sec.-ft. developing a 505-ft. effective head, to 10 sec.-ft. developing a 657-ft. head. The amount of change in effective head is due to the large variation of friction head in the long line of small diameter.

Under these conditions efficiency and flexibility were believed to go hand in hand and the equipment decided upon was two 1,350-hp. Pelton double overhung impulse turbines equipped with electrically-operated needle nozzles and governor-operated jet deflectors. Two units with two runners each were chosen in order to maintain efficiency on partial loads. With this arrangement the friction and windage losses are small and are considerably less than would be the case if an equal amount of water were used in a single duplex nozzle unit of double the capacity and with larger and heavier generator and larger wearing surfaces.

Both units are supplied equally when the maximum quantity of water is flowing. As the flow decreases each unit supply is decreased to the point where the efficiency of the individual units tends to drop. Then one unit is shut down entirely and the one remaining is opened to take all the flow. As the flow continues



TWO MAIN UNITS AND TWO EXCITER SETS

to decrease the needle openings of the two nozzles of the operating unit are gradually closed equally until the efficiency of the unit again tends to drop. At this point one jet is entirely shut off and all the water diverted through the remaining nozzle. The efficiency at this lowest point is only 3 per cent below the maximum efficiency developed under the most favorable conditions. As the flow increases the reverse order in the opening of the nozzles is followed.

As the quantity of water flowing is the important factor rather than the load requirements, the operation of the turbine unit is controlled by the quantity of flow and the governing and control equipment was designed accordingly, every effort being made to obtain close regulation. A long distance water level indicator is installed at the plant to show the level of the water in the forebay. The operator in the plant is guided by the indicated water level and manually controls the needle nozzle openings, though the needles themselves are electrically operated.

The hydraulic equipment for the Fontana plant was designed by the Pelton Water Wheel Co., San Francisco.

KILOWATT-HOURS GENERATED AT FONTANA, MONTH BY MONTH

Month	1917	1918	1919
January	.....	752,000	804,000
February	.....	652,000	632,000
March	.....	1,282,000	738,000
April	.....	1,451,000	833,000
May	.....	1,266,000	754,000
June	.....	955,000	581,000
July	.....	1,144,000	494,000
August	.....	1,241,000	472,000
September	.....	1,066,000	449,000
October	.....	1,122,000	602,000
November	.....	901,000	533,000
December	188,000	844,000	555000

LETTERS TO THE EDITOR

Technical Engineers Neglected in Labor Board's Wage Award

Sir—The rail award given out July 20 by the United States Railway Labor Board contained no increase for the technical employees of the engineering departments of the railroads. In fact these engineering departments did not appear to exist. The newspapers informed the public that all departments of the railroads received some increase and in the list of all departments there was to be found no reference to any engineering departments.

Why was this? Of all the 57, or more, technical societies and associations in this country was there none which attempted to plead the cause of the engineers before the Board? If there were any, then what reasons were given for discriminating against the engineers? Is it improper for the engineers of this country to demand an explanation from the societies as to why they neglected this opportunity to effect recognition and to gain a salary increase for the whole body of technical employees of the railroads?

Danville, Ill. WALTER J. SYKES.

Engineer's Duties on Cost-Plus Work

Sir—In H. M. Bryant's query on p. 40 of your issue of July 1 in regard to the duties and authority of the engineer on cost-plus-percentage construction work, he describes difficulties and perplexities which need not exist and which certainly can be avoided by the simple precaution on the part of the owner of selecting the builder with the same care supposed to be exercised in the selection of his engineer. A man is known by the work he does and there is no reason why the owner should be more fortunate in the selection of the engineer than in the organization to do his building.

Why can we not be fair to the successful and reputable contractor and credit his success to honesty, energy, ability and his desire to give his client a first class job in order that he may find another one when that is completed? The aim of this sort of man is not simply to "get by" the engineer; good, fair or poor work will do that, depending on who the engineer happens to be, but why not have confidence in one as well as the other?

When Mr. Bryant goes to the tailor for a new suit of clothes he does not employ an inspector to sit by while it is being made, but if he does not get the worth of his money he goes elsewhere the next time and advises his friends to do the same. This method soon puts the dishonest tailor out of business or leaves him only such customers as desire his class of work.

The country is full of expert builders, specialists in their lines, who are up-to-date business men with large sums of money invested in their plants and organizations. These men know better than the general public that their business depends on the class of work they do so why should one be viewed with suspicion and a careful watch set upon him the instant he moves on a job? Ordinary business policy demands that proper records and check be kept on all expenditures and the man who is paying the bills should most certainly be properly represented and his interests safeguarded, but if the owner or his engineer is assumed to be more capable of directing operations than the contractor why employ him at all?

Business men who have construction work to do should not overlook the obvious fact that it costs money to get and hold together a first class plant and organization with which to do his work and the better it is the more it costs. When one of these same business men consults a lawyer or physician he does not look for the one who will advise him for the least money but goes to the one whom he knows to be reputable and generally gets the kind of service he wants; he can apply the same method to the selection of his builder with results equally as satisfactory.

Addison, Ky. H. G. MCCORMICK.

"Crossover Practice" and Standard Fees In the Legal Profession

Sir—In the article "Crossover Practice" in your issue of June 24 offers the following paragraph:

"In the legal profession admission to the bar admits to general practice and reaches into any specialty in which a lawyer may wish to enter. A real estate lawyer may defend a murderer and a criminal lawyer may try an involved insurance case. A corporation lawyer may serve in riparian disputes. A specialist in insurance may try an admiralty case."

These statements are entirely correct, but only if the word *may* is in each case accented. It is a rare thing that a man specializing in any branch of civil practice is engaged in criminal cases. The "corporation lawyer" (an attorney in the employ of a corporation) is of course liable to be called on to try a riparian case if his employers are interested in such matters, but admiralty practice is meddled with but little by the general practitioner. Of course he *may* appear in any matter whatever if requested to do so, but I do not think that attorneys are less confined to specialties than engineers.

Another article contains the statement that "in the legal profession there has been no action for standardizing fees," and takes a needless slap at the legal fraternity in the statement that a standard schedule of fees would probably be opposed by many lawyers because it would serve in many case to protect the client against exorbitant charges. It would seem that if the writer had made any research worth mentioning he would have found that, far from it being a fact that there has been no action for standardizing fees, such action has in most localities preceded similar action by any other profession. I know of no county in this neighborhood where there is not a fee table established, and in a very wide stretch of country now the so-called "uniform fee bill" has been adopted so far as commissions on collections are concerned. Thus a client at a distance can readily ascertain what commission will be deducted from any collection. Again, in every county that I am acquainted with there is a regular schedule of fees for drawing legal instruments and for all routine matters before the various courts, all such fees being of course the minimum charge. In the preparation and trial of important cases any fixed rate is of course out of the question.

The following is quoted from the preamble to the latest fee bill of the Knox County bar: "We hereby establish the following schedule of fees and rates of compensation as the lowest which we can reasonably and honorably receive, but these rules are not intended to restrict members of the Bar from receiving larger fees in cases of difficulty or magnitude." This is I believe in spirit as well as letter substantially the same as the sum of all fee bills of all professions. O. H. TRIPP.

Rockland, Me.

Prohibition, China, and the Railroads

Sir—In a letter in your issue of June 17, Mr. F. C. Finkle of Los Angeles makes this surprising statement: "They (the Chinese) come from a country where prohibition was first adopted, 459 B.C., and has been enforced so long that the Chinese Empire has lost its power and the people have degenerated through the use of drugs and narcotics taken as substitutes," etc.

If my recollection of history is good, there were other great empires in the world, in 459 B.C. and the centuries immediately succeeding, where the use of alcohol was not prohibited. Have Persia, Greece and Rome stood the test of time so much better than China? I should like to hear Mr. Finkle discuss this point.

Regarding the Railroad Problem:

Has anyone recently considered putting the railroads as nearly as possible on the basis of the public highways? We do not expect the highways to be self-supporting, why should we expect more of the railways which are really only another kind of a highway? Making proper allowance for interest and renewals, was the country's railway system,

taken as a whole ever self-supporting anyway? I should like to see this question discussed by a competent authority.

Why not let the government take over the rails and roadways and maintain them as it does the highways? For operation divide the national system into convenient units and lease each to the highest bidder for a reasonable term of years. The proceeds from the lease, supplemented by taxation as necessary, would maintain the roadways. Doubtless many trunk lines would lease for more than the maintenance cost, the surplus going to help make up deficits elsewhere. In this way most of the benefits of private operation could be retained, while the evils of a direct subsidy would be avoided. At the same time the corporations would be relieved of much expense which evidently cannot be met under present conditions.

Southbridge, Mass. H. F. AMMIDOWN, Surveyor and Genealogist.

Shrinkage of Earthwork

Sir—I have read with interest and profit your article on "Shrinkage of Loosely Filled Earthwork in Embankments" in *Engineering News-Record* of June 24. On p. 1257 appears the following statement: "A rule issued by the engineering section of the Division of Valuation in 1918 specifies a shrinkage allowance of 10 per cent." For your information, I write that the rule referred to provides that in no case shall 10 per cent be exceeded, but a less allowance shall be made in case of recent construction and where 10 per cent is clearly too high.

My understanding is that shrinkage is taken to mean the difference between the volume of existing seasoned embankment and of original excavation, including not only the shrinkage proper but also such variable factors as loss in transportation and losses which may occur from erosion and other causes during the construction period.

EDWIN F. WENDT, Member, Engineering Board, Interstate Commerce Commission.

Washington, D.C.

On the Efficiency of Union Labor

Sir—There has been much discussion in the past few months of the relative efficiency of labor at the present times as compared with the period preceding the war. We have the statement of Louis Horowitz, president of the Thompson-Starrett Co., New York, to the effect that while a competent brick mason can lay 2,000 brick per day, and was actually laying from 1,200 to 1,500 in 1916, he is laying only from 600 to 700 at the present time. Offset against this is the opinion of many managers that labor is doing its share, and that there is too much of a tendency to criticize labor for conditions beyond its control.

In this connection a very interesting study has been made of the operation of unloading ships of the Morgan Line at New Orleans after their trip from New York. There are three combined passenger and freight steamers on this line—*Creole*, *Comus* and *Momus*. These ships are practically alike, having been built in 1906. A comparison of the number of tons of cargo handled from these ships on five consecutive voyages of each ship in 1914 has been made with a similar record of the past winter. The results are rather startling.

It is shown, for instance, that in 1914 on five trips there were unloaded from the *Comus* 7,872 tons of cargo with the expenditure of 20,218 man-hours on the wharves. During five runs in 1919-20 the tonnage unloaded was 7,748 or nearly two per cent less than in the previous period. But the man-hours required for the work amounted to 28,638, or an increase of 42 per cent. For the three ships with a total of 15 voyages in each of the two periods it was found that the total tonnage unloaded increased from 26,831 in 1914 to 27,092 in 1919-20—a gain of not quite 1 per cent. But the man-hours required for the work in 1914 were only 70,196, as compared with 99,063 in 1919-20. This is an increase of 41 per cent in man-hours, to cover an increase of 1 per cent in tonnage.

Hours of labor having been slightly reduced, the question of fatigue from a long day's work has been practically abolished. It has been suggested that the influence of prohibition is largely responsible for the above result, this being on the theory that a longshoreman will work about two hours at top speed if he has some alcoholic stimulant under his belt, and then requires further stimulant before the next two hours of work. It seems to the writer that this view is an ex-parte one, of a type particularly prevalent at the present time, and that it is entitled to very scant consideration. However that may be, we have the definite facts as set forth above, the figures having been prepared by E. E. Lamberton, in charge of operations at New Orleans, for the Southern Pacific Steamship Co., which owns and operates the Morgan Line.

The figures as given show in each case fifteen consecutive unloadings of the same three vessels at the same wharf, carrying the same kind of cargo, which was handled under identical conditions by practically the same men. The number of pounds handled per man-hour has decreased from 793 in 1914 to 547 in the present period, and the number of man-hours expended per ton of cargo unloaded has, in the same period, increased from 2.616 to 3.657 man-hours, or 39.8 per cent.

An interesting side-light on the same situation shows that pilfering on the wharves has undergone a tremendous expansion. In 1914, in connection with the fifteen voyages covered in the figures, there were thirty-four claims paid, aggregating less than $100. In 1919-20, under the same set of conditions, there were 655 claims paid, aggregating more than $20,000. SIDNEY G. KOON, M. E.

Boston.

Shall Chinese Labor Be Imported?

Sir—Present laws do not favor the importation of Chinese labor and no political party wants it or could afford to legislate in its favor. That being the case it simply will not happen and time might be more profitably spent in increasing the efficiency of our own people than in wishing for the Asiatics.

This country has periods of depression when labor is not fully employed. Organized effort was necessary to find places for the returning soldiers last year. Simultaneous undertaking of works of extraordinary magnitude when labor is short could and should be avoided. Extensive programs for road building and municipal improvements can be deferred until slack times. In that way the public work would be done at less cost to taxpayers, the tendency would be toward more uniform activity in all lines. It seems that we can better afford to try other expedients to keep things moving than to bring in any more race problems, for they are harder to solve than present labor problems. The sentiment seems pretty general that there are too many aliens now who live in America but will never be Americans. GEO. C. LOVE,

Newport News, Va. Civil Engineer and Surveyor.

Sir—Replying to the letter of John Ericson relative to the desirability of the importation of cheap coolie labor permit me to state that I am positively opposed to such a measure as one wholly unsound in economic principle and dangerous to the social fabric of our nation. The United States is the most favored nation of the world from the standpoint of natural resources. Its people are resourceful, intelligent, and progressive to a degree that is unsurpassed, and therefore capable of producing all that is necessary for their comfort or advantage. These facts alone controvert any argument of necessity for the importation of any labor whatsoever, whether skilled or unskilled, that the nation may prosper.

In thoughtless moments we are all wont to complain at the scarcity of labor and its high cost, forgetful of the fact that scarcity of labor and high wages mean improved living conditions for our laboring classes, better educational advantages for their children, more happiness for them, and the attraction to unskilled work of better educated, more skilled, and more capable men—a combination of brain and

drawn which spells progress instead of industrial stagnation.

It was said that "this nation cannot endure half slave and half free" and with equal force it may now be said that this nation cannot prosper and progress with its workers on two planes—one to which neither privilege of citizenship nor assimilation is denied, and one to which all privileges of citizenship and assimilation are denied. The nation is even now cursed with the problem of caring for one class of non-assimilable workers introduced by our forefathers in colonial days because there was a scarcity of labor, and this example alone should be sufficient to hush the argument for the importation of more.

There is now and there always will be (in spite of the most improved living conditions) a certain percentage of our people not richly endowed by nature with mental power, ambition, and capability. These gravitate naturally into the unskilled and rougher work, and into competition with them would be thrown any unskilled workers imported, thereby adding to the handicap imposed upon them by nature. This competition would bring poorer living conditions to this unfortunate class of our citizens, decreased advantages for their children, an increase in social unrest, and a reflection of discomfort all the way up through the labor world.

In conclusion let me point out that everyone of us, whether he be the humblest worker with pick and shovel or the whitest-collared, highest-salaried specialist, is a member of this labor world; that unduly high wages or fees cannot long endure for any one class of this labor world because the very attraction which high wages or fees afford introduces healthful competition from out the other classes and automatically brings an adjustment; and, that the bringing, by importation, of any class of inferior foreign labor into competition with a domestic class of labor means not only lowered living conditions for the latter, but for every other class of our domestic labor. The importation of the most skilled hands and inventive minds may well be encouraged because the productivity of our own labor and the sum total of the nation's happiness may thereby be increased. The importation of a class of labor lower than our domestic supply is degenerating, will increase our misery, and can have no sound basis in economic principle.

EVERETT N. BRYAN.

Waterford, Calif.

Sir—In your issue of June 17 you print a letter from F. C. Finkle which discusses the admission of Chinese laborers, and we have noted that Mr. Ericson and "the best men in the country" are thoroughly criticized for their failure "to grasp the cause, much less the true remedy, for our serious labor shortage." While I do not care to enter into a discussion of the relative merits of the various views that have been advanced as to what should be done, I feel that I ought to object in writing to the attitude of Mr. Finkle on two general grounds: (a) Because of his unreasonable antagonism to prohibition, for which every right-minded man has been praying for these many years; and (b) because the classing of all Chinese with the degenerates is an insult to a friendly people that as true Americans we should very promptly resent as being entirely uncalled for, and as junkerism, if not downright propaganda of the brewers' association.

China looks to America as its one true friend and if Americans show even a spark of human decency and sympathy there is bound to develop a mutual co-operation that will go far to protect us against future encroachments of the Japanese, to say nothing of the opening up of satisfactory solutions for other great problems. The people of the Philippines are well aware of the importance of retaining the protection of the United States Government after they have become self-governing as a necessary guarantee of the perpetuation of their freedom and independence. Japan is a nation controlled by expediency, but China is honest and trained in the arts of peace and her backwardness is more the result of the deadening effect of her religious instruction than to any lack of brains and ability. Christian civilization, imperfect as it has been shown to be, has made America possible and it is the thing that can make China what it is hoped she will some day become—a friendly nation trained in honest intentions and peaceful pursuits. We cannot afford to antagonize a nearby (as distances go nowadays) nation, even unintentionally, which is possessed of such enormous latent power for good or evil. We should do our unmost to cultivate China's friendship by acts of kindness and expressions of goodwill and lofty sentiments.

It has lately been necessary for me to investigate the conditions that exist between America and China in connection with an opportunity offered me to serve the young men and the people there as an engineer and as an educator. Through personal correspondence I have been able to get a viewpoint that is intimate and human. As a result I am convinced that Chinamen look to America for guidance and help, but that America ought not expect large returns in a material way and should be satisfied with a knowledge of work well done in the great cause of humanity. Selfishness will undoubtedly destroy America's chance. Americans are wanted to guide the Chinese to the light but they must be willing to go forward slowly, beginning with things as they are and building step by step and soundly, giving the best that is in them. If they go to China's assistance for any lower motive than to be of complete service to China and her people it were better that they should perish before they do irreparable harm. Americans now are respected and may go anywhere that a Chinaman may go. Chinamen crave American aid in order that the bad influence of the Japanese may be offset. As there is no military question or suspicion between Americans and Chinese, mutual confidence is possible.

American educational institutions are very popular with the Chinese generally and they stand very high in comparison with either the government institutions or those supported by other nationalities. The important thing to be kept in mind in relation to this effort of Americans to help is that the real justification for American colleges in China taking up professional work such as engineering lies in their ability to give to their students the highest type of idealism and to emphasize all those factors that go to make up that complex thing we call character. The Chinese Government schools do not do this. Engineer graduates of the American institutions have this factor of character in addition to their purely technical training which ensures their rising to leadership in the profession in China and so be in a position to help to keep the ethics and practices of the engineering profession on as high a plane as in the West. It will be very serious for China if she has to rely entirely on the men educated under the demoralizing influences of the government schools to direct her great engineering works and to spend the millions of dollars that will be spent there in the years to come shortly. So there should be a greater spirit of helpfulness and co-operation shown, for if we need the help of Chinese labor, the Chinese need our help even more.

The first great convention of Chinamen ever held, to cement friendship between America and China and to establish better understanding between the two nations, has but lately met in San Francisco under the auspices of the Chinese National Welfare Society of the United States, which has a membership of 15,000. It is proper that we should approach the Chinese labor problem in the spirit of mutual respect and cordiality. Full and unqualified support should be given to this attitude by every loyal American, since only by encouraging mutual goodwill can we hope to protect ourselves against the "yellow peril" that is going to come whether we will or will not have it.

In conclusion let me say that I believe that the Chinese laborer will make a far better and more desirable citizen without his beer than the Polish, Slavonian, Italian, Swiss or Greek laborer who has quit our great and glorious country for a country where he can have his intoxicating beverage which destroys efficiency and weakens resistance to disease and makes the kind of citizens we call undesirable aliens—the kind we do not want.

EDWARD G. SHEIBLEY,
Consulting Engineer.

Los Angeles, Cal.

HINTS FOR THE CONTRACTOR

Checking Actual Unit Costs Against Estimates

BY CHAS. P. RUMPF
Fairmont, West Virginia

THE cost data chart herewith illustrated is a departure from the customary curves, or co-ordinate system of plotting, and possesses the advantages of giving immediately an unusual amount of information in concise form. This style of chart is particularly applicable in checking an estimate of costs as the actual work progresses. Taking for example the item *concrete*, it will be seen that the following information is at once available: (1) The unit estimate per cubic yard; (2) the total estimate in dollars and in yardage; (3) the amount spent during each week; (4) the corresponding yardage placed in this period; (5) the actual unit cost per week; (6) the actual unit cost to date; (7) the state of completion as compared with the estimated quantity.

It is apparent that when the actual unit cost to date agrees with the estimated unit cost, the line joining amount spent and quantity placed will be horizontal, and, furthermore, that a departure from the estimated unit cost will be indicated by the line joining cost and quantity sloping towards the dollars or the quantity as the actual unit cost is less than or greater than the estimated unit cost. Another useful fact readily determined is the relative value of the various items as shown by their respective heights.

This form of chart is being issued weekly under the writer's direction by the architects Dreher, Churchman, Paul & Ford in connection with a building project in Fairmont, W. Va.

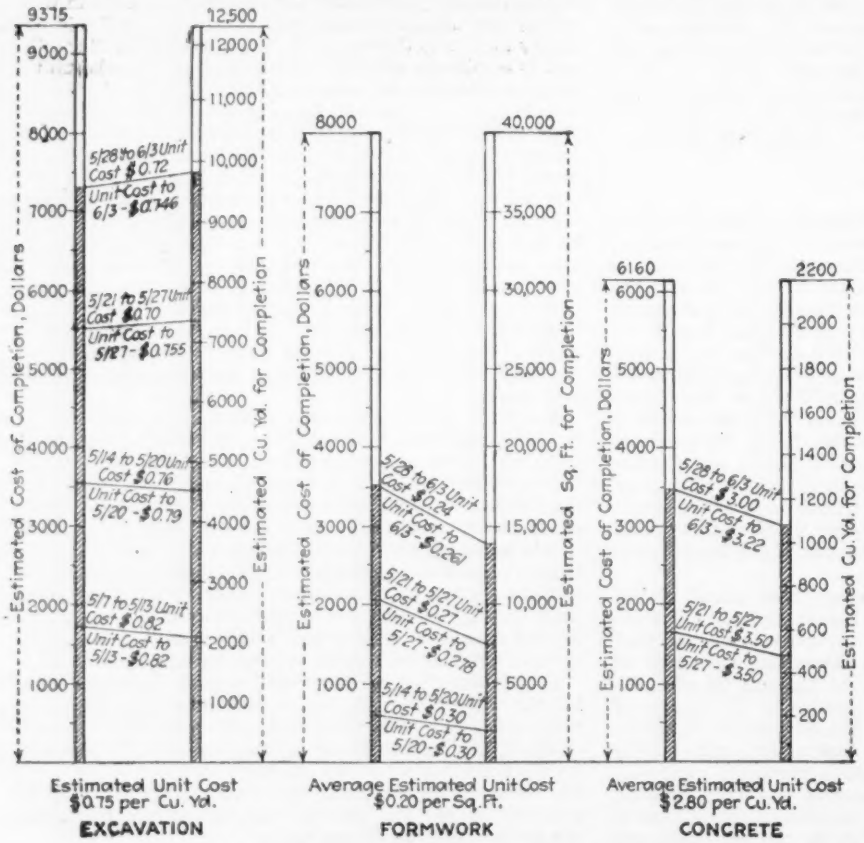

9375
12,500
8000
40,000
6160
2200
Estimated Cost of Completion, Dollars
Estimated Cu. Yd. for Completion
Estimated Sq. Ft. for Completion
5/28 to 6/3 Unit Cost $0.72
Unit Cost to 6/3 - $0.746
5/21 to 5/27 Unit Cost $0.70
Unit Cost to 5/27 - $0.755
5/14 to 5/20 Unit Cost $0.76
Unit Cost to 5/20 - $0.79
5/7 to 5/13 Unit Cost $0.82
Unit Cost to 5/13 - $0.82
5/28 to 6/3 Unit Cost $0.24
Unit Cost to 6/3 - $0.261
5/21 to 5/27 Unit Cost $0.27
Unit Cost to 5/27 - $0.278
5/14 to 5/20 Unit Cost $0.30
Unit Cost to 5/20 - $0.30
5/28 to 6/3 Unit Cost $3.00
Unit Cost to 6/3 - $3.22
5/21 to 5/27 Unit Cost $3.50
Unit Cost to 5/27 - $3.50
Estimated Unit Cost $0.75 per Cu. Yd.
EXCAVATION
Average Estimated Unit Cost $0.20 per Sq. Ft.
FORMWORK
Average Estimated Unit Cost $2.80 per Cu. Yd.
CONCRETE

CHART ALLOWS GRAPHIC COMPARISON OF ESTIMATED AND ACTUAL UNIT LABOR COSTS

Wooden Runway Solves Trucking Troubles on Sandy Subgrade

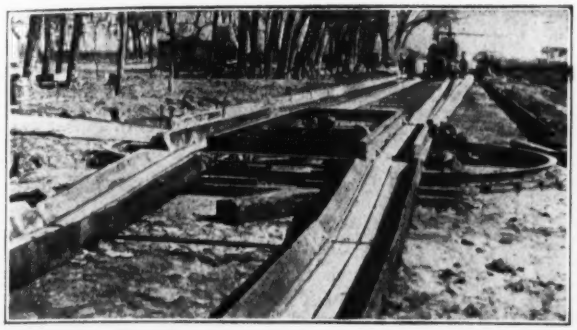
BY THOS. E. BURTON
Resident Engineer, Sedgwick Co., Kansas, Federal-Aid Roads

IN LAYING the concrete base for the bituminous-filled brick road leading south from Wichita, Kansas, and known as Federal-Aid Project No. 24, Sec. A a method was developed which proved both practical and economical. This road is on a sandy soil, a fact causing great difficulty in the transportation of materials. The clay surfacing which had been put on by the county is removed in the grading and used where possible for the earth shoulders. Because of this the contractor found it advisable to carry his rough grading only a short distance in advance of his concreting. The method used in 1919 was to place the material on the subgrade and handle it in barrows to the mixer. This was found to be expensive procedure, especially because the finished grade was continually cut by the trucking.

To overcome the high cost of construction and increase the output simultaneously the Bickel Contracting Co., which is building this road, changed to the proportioned-batch system, hauling five two-sack batches to the truck. This meant the reconstruction of their storage bins. The truck is driven under the sand bin to the stone bin where the five batches of stone are dumped; it is then backed to the sand bin where the five batches and sand are loaded. Every fourth truck carries one batch of curb material which is different from the base material since the curb is integral. From the sand bin the trucks are driven to the cement sheds where two untied sacks are placed on each batch whenever there is considerable wind or when rain threatens, otherwise the cement is dumped direct into the batches. This loading operation takes an average of three minutes. When the trucks reach the work there is put into operation a steel turntable as illustrated which has

eight ball-bearing 8-in. rollers that run on an H-section circular track. This turntable is placed 300 ft. ahead of the mixer and between it and the mixer is laid a wooden steel-shod track upon which the trucks back to the mixer. The track is made in 9-ft. interlocking sections held apart by ¾ in. hooked rods spaced every 9 ft.

The turntable occupies the space of the two track sections and can be set ahead at any time and be replaced by track. When the concreting has reached the turntable the removed track sections are then laid in advance and by the use of two-wheel carts the turn-



SECTION OF WOODEN STEEL-SHOD TRACK AND TURNTABLE USED ON FEDERAL-AID WORK IN KANSAS

table is moved down the track to the new location. At the beginning of the day's operation half way between the turntable and mixer three sections of form are taken out on one side and three sections of track are removed and replaced by planks, thus the returning empty trucks can turn out and drive down the shoulders and the incoming trucks are never more than 150 ft. from the mixer. After the mixer reaches this opening another is used which was left at the turntable. During the day forms are continually being set and upon them a subgrading machine is run just before the track and turntable are moved. The time required to move track and set turntable is forty minutes.

Cost Cut 60 Per Cent

The contractor made sufficient track to operate his concreting unit seven hours; the other hour is used in preparing for the next seven hour's run. This method of operation has cut the cost per square yard of base laid to 60 per cent of the cost of the method used last year. With a few improvements that are being added from time to time the efficiency of this kind of operation apparently will equal that of any other method now in use. It is quite possible to increase the output by expanding the system in some direction, but, as it is, the correlation of the parts and their functioning on time is very good and it is a matter of making the increases according to the readily ascertainable percentages of their value to the whole.

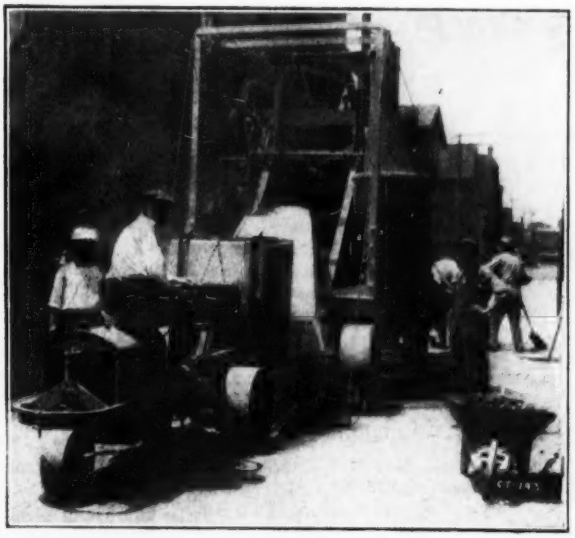
Dump Car Loaded Through Hopper

In loading trains of small steel dump cars from a revolving steam shovel on a grading job in Australia, the bucket dumped its contents into a steel hopper supported over the track on a steel frame mounted on small wheels. This method avoided spilling of the material and possible damage to the cars by striking them with the bucket or its door.

Increase Alley Pavement Output

AN OUTPUT increase of nearly 40 per cent has been accomplished on recent alley paving in Chicago by adopting mechanical loading from stockpiles and truck-tractor dry-batch haulage. With hand loading from stockpiles and wheelbarrow charging the output per day of 15 ft. 4 in., alley pavement 7 in. thick averaged about 550 sq.yd., with favorable weather. A crew of twenty-seven men was required. Using the mechanical equipment and the same crew the output, regardless of weather conditions, was increased to 750 sq.yd.

As alley paving, generally, is prosecuted it consists of about 1,100-sq.yd. operations often widely scattered so that many moves of the outfit are necessary during



PROPORTIONED BATCH DUMPED DIRECTLY INTO MIXER SKIP

a season's work. Alleys in Chicago average about 15 ft. 4 in. in width and are paved full width using 1:2:3 concrete. With the limited width and no side space, stock storage is complicated. In general the conditions are such as tend to retain simple mixer outfits and hand methods to supply the mixer and to place the concrete.

In choosing the mechanical outfit, attention was given to the fitness of each unit for its particular task. For loading stone from piles a Barber-Greene loader was selected and for loading sand a Jeffrey loader. These loaders lift the stone and sand into hoppers whence they are measured 9 cu.ft. of stone and 6 cu.ft. of sand into the bodies of the four trucktractors. The cement is loaded by hand. A round trip haul of 1,000 ft. is made from stockpiles to the paving mixer in about 3 min., which keeps the mixer, making a 1-min. mix, busy. The accompanying view shows a truck dumping the dry batch directly into the mixer hopper.

The operating crew of 25 men in charge of a foreman and a receiver, consists of one operator and two laborers on each of the loading machines; four truck-tractor operators; three men loading cement, and, at the mixer, one man on the dry side, four on the wet side, two mechanics, one fireman, one man on expansion joints, two fine graders and two form setters. The contractor is the Schmidt Construction Co., Chicago.

NEWS OF THE WEEK

New York, August 5, 1920

Bureau Public Roads To Report on California Highway System

A complete economic study is to be made of the highway system of California by the U. S. Bureau of Public Roads. The evolution of the California highway system will be investigated carefully and a study made of its relation to the development of the state. The survey will also include a careful analysis of the traffic now being carried by the California roads.

It is believed that the survey in California will develop many facts which will be applicable throughout the country. In addition, the study will enable the Bureau's engineers, it is believed, to give some helpful professional advice to guide the California Highway Commission in the future.

The study is to be undertaken in response to a request for such a survey from the California Commission as noted in the *Engineering News-Record*, July 15, 1920, p. 140.

Associated Contractors Urge Consideration of Construction Needs

General R. C. Marshall, Jr., formerly Chief of the Construction Division of the Army, who lately accepted an appointment as general manager of the Associated General Contractors of America, has addressed to the chairmen of the Republican and Democratic National Campaign Committees the following open letter emphasizing construction needs as one of the big domestic issues in the coming campaign.

It is with interest that I note the attention given to the need for construction of various kinds in the platform recently adopted by the National Convention of the Republican Party.

In that document the Republican Party goes on record in favor of liberal appropriations for the construction of highways, the encouragement and development of water transportation and facilities, the restoration of railroad credit to furnish enlarged facilities, the promotion of water-power development, and the encouragement of home ownership and town-planning by the federal government. Every one of these problems touches a vital spot in the work of reconstruction which we are facing, in which construction so long deferred must play an important part.

When it is realized that the construction industry is second in importance only to agriculture in the United States, I believe it is not amiss to point out to you the need for giving this great organ of the body politic prime attention in the coming discussions of national issues preceding the presidential election.

The attention of the business men of the the issues presented by the platform of the issues presented by the platforms of the two great policial parties more than in any election for some time past. Nor will they be content with a discussion of international policies only at a time when domestic problems are pressing for attention. For example, we are facing during the present year a construction program estimated at the unprecedented total of

(Continued on p. 286)

Fire Causes Slight Damage on Williamsburg Bridge

Short circuiting of a feeder cable on the night of July 29 caused a fire on the Williamsburg Bridge over the East River, New York City. The burning of a portion of the wooden floor construction, including ties and inside and outside guard timbers along the railway tracks, has made necessary the replacement of 33 weakened stringers, although, according to a statement of Samuel Hamburger, engineer in charge of the bridge for the Municipal Department of Plant and Structures, no major part of the span is damaged. Repairs are now being made. Orders for new stringers were received by W. Rees, plant superintendent of the National Bridge Works at Long Island City, at 10:30 a.m. July 30 and by 7 a.m. the next day, Sunday, the first load of new steel members had been fabricated and delivered by motor truck at the bridge site. The accident has not necessitated a shutdown of vehicular traffic over the structure, although service on the electric railway lines has been interrupted.

New York Plans New North River Piers

The first step in the replacement of a number of old North or Hudson River piers by new ones has been made by the city administration of New York City. This step consisted in the action of the Sinking Fund Commission authorizing the expenditures of funds to supplant thirty-two antiquated piers between Vesey and Perry Sts. on the lower part of Manhattan Island with eighteen new piers. Most of the old ones are of thirty years' standing and are narrow with narrow slips. Two of the new piers will be 100 ft. wide, seven 150 ft. wide, and nine 125 ft. wide. They will be from 900 to 1,025 ft. in length. The scheme for the new development has been worked out by Murray Hulbert, commissioner of docks, but its details have not yet been announced.

A. A. E. Has 20,000 Members

The American Association of Engineers passed the 20,000 membership mark July 28. The association was organized in 1915, five years ago. At the beginning of 1919 it had about 2,300 members. At the beginning of 1920 it had 10,450 members. The growth in 1919 was 8,150 members; that in the first seven months of 1920 was 9,550.

Since the first of the year 1919 the number of local chapters and clubs of the association has increased from 26 to 209.

Officials Urged To Accept Engineer Compensation Schedule

Governors of all states, mayors of leading cities, directing heads of federal bureaus having jurisdiction over engineering work and civil service commissioners have been urged by letter to accept Engineering Council's recommendations governing the classification and compensation of engineers. The communication, signed by Arthur S. Tuttle, chairman, and Charles Whiting Baker, secretary of Council's committee, follows:

It is doubtless known to you that engineers in all branches of the profession have suffered serious hardship during the past three years from the great decrease in buying power of the dollar. In few cases has their pay been increased sufficiently to offset any large proportion of the increased cost of living.

Engineering Council, which represents over 45,000 engineers in all parts of the United States, has had this matter under investigation for over a year. We send you herewith an abstract of the report of the Council's special Committee on the Classification and Compensation of Engineers. This report contains a standard classification of grading for engineering service, with a tentative schedule of standard rates of compensation in each of the proposed grades.

Engineering Council has approved this classification, and it is believed to be applicable to all branches of engineering service.

The classification was endorsed by the Municipal Engineers of the City of New York at a meeting of that society held on May 26, 1920, at which time a schedule was adopted providing for compensation at a rate approximately 20 per cent greater than that tentatively suggested by the committee. The classification has been closely followed by the Congressional Joint Commission on the Reclassification of Salaries in its recommendations concerning engineers in the Federal service (see *Engineering News-Record*, April 15, 1920), and it was approved by the Executive Committee of the American Society for Testing Materials on April 13, 1920. The endorsement of the tentative schedule of compensation was recommended to the Boston Society of Civil Engineers by its Committee on Compensation at a meeting of that society held on May 19, 1920, and is now being made the subject of a letter ballot by the full membership. It will thus be seen that substantial progress has been made in bringing about a recognition of Engineering Council's classification as *standard*.

The adopted classification and the corresponding schedule of compensation tentatively suggested are as follows:

Adopted Grades.	Compensation Schedule (Tentative)
Junior Aid	$1,080 to $1,560
Aid	1,680 to 2,400
Senior Aid	2,520 to 3,240
Junior Assist. Eng.	1,620 to 2,580
Assistant Engineer	2,700 to 4,140
Senior Assist. Eng.	4,320 to 5,760
Engineer.	5,940 and upwards
Chief Engineer	8,100 and upwards

We desire especially to urge upon you that this question of satisfactory compensation for engineering service is one which affects the public even more vitally than it does the engineers themselves. Upon the quality of service rendered by the engineers who design, plan and execute construction work, its cost and serviceability will largely depend. Our investigations have shown that the public is already suffering loss as a result of the great reduction in engineers' compensation.

The need of a standard classification and

(Continued on p. 287)

No Steam Auxiliary at Niagara

The Ontario Hydro-Electric Power Commission has decided not to proceed with the construction of an auxiliary steam plant, as tenders received show that, owing to the high cost of labor and material, the cost of a 50,000 hp. unit would exceed $5,500,000, and the extra power to be made available could not be secured for a year and a half. This initial expense and the cost of operation due to the high price of coal would, it is estimated, add at least $10 per hp. to the cost of power in the Niagara distict. The Commission has been advised by Hugh L. Cooper & Co., the New York engineers, who are preparing a report on the Chippawa-Queenstown power development, that two units of 55,000 hp. each will be ready for operation by Oct. 1, 1921, provided there is no further interference with the construction program of the Commission.

Pennsylvania Reports Arrests for Truck Overloading

Within the last few weeks a number of arrests of automobile truck drivers have been made at the instance of inspectors for the automobile division of the state highway department, and many men have been fined for carrying overloads on their machines, says a recent bulletin from the Pennsylvania Highway Department. Several weeks ago inspectors for the department and state policemen began an inspection of the trucks coming into Pennsylvania. These officials were equipped with lodometers, or "jack scales," with which it is possible to get the approximate weight of trucks. The lodometer is a mechanism with a jack attachment and is placed under the axles of trucks suspected of being over weight. Two lodometers are placed first under the rear axle, which is then jacked up. The dials on the lodometers give the weight carried on the rear end of the truck. Then the lodometers are moved to the front axle and that end is raised. The total weight registered front and back gives the approximate weight of truck and load. Under the state law trucks must have painted on the outside the maximum weight limit permitted by the manufacturer of the car. If the lodometers show that this weight limit has been exceeded the inspectors take the truck to the nearest scales where an exact weight is secured.

Under the law no commercial vehicle may carry a weight greater than that specified by the manufacturer. It is on this point that arrests are now being made throughout the state. The automobile division inspectors find that the greatest loads are being carried after dark; and they report steady streams of huge motor vehicles constantly plying between New York and New Jersey points and Philadelphia.

The fine for over-loading trucks is from $25 to $100 and in addition costs are levied, or a six months jail sentence may be imposed.

Hold Up $3,000,000 Pipe Line at Seattle

L. B. Youngs, superintendent of water of Seattle, Wash., has recommended that no action be taken toward the construction of the proposed $3,000,000 68-in. steel pipe line from Molasses Creek to Volunteer Park Reservoir, as part of the municipal water system. The lowest bid received early in the year for the construction of the 18-mi. line would involve an expenditure of $3,600,000, which is considered prohibitive. The bond market is also considered very discouraging at this time. Mr. Youngs states that he has reason to believe that by waiting until next February a saving of $25 a ton on the 14,000 tons of steel needed may be effected.

Street Cleaning and Other Bids Wanted at Philadelphia

Bids are wanted until Sept. 15 by the city of Philadelphia for (1) street cleaning for 1921; (2) collection and disposal of ashes for 1921; (3) collection and disposal of garbage, dead animals, etc., for 1921, and (3b) for disposal alone, for one year and also for five years; (4), (5) and (6) new equipment for street cleaning, collection of ashes and rubbish and collection of garbage, etc.; (7), (8) and (9) used equipment for (4), (5) and (6). Specifications may be obtained from the Bureau of Street Cleaning, 334 City Hall, Philadelphia. Frank H. Caven is director, Department of Public Works, and John H. Neeson is acting chief, Bureau of Street Cleaning.

The new charter of Philadelphia provides that the city must itself do the other work now being advertised *unless* the mayor and a majority of the new city council of 20 members decide to have it done by contract. A committee of engineers recently advised (see *Engineering News-Record*, July 29, p. 236) that the work be done by the city, beginning in 1921, with the exception that contract work for ash and refuse collection be continued during 1921. It is reported that the call for bids noted above is designed to secure cost figures for inclusion in the 1921 budget, in case the city concludes to have some or all the work done by contract. The mayor has requested the council to make an appropriation of $15,000 to pay for estimates of the value of the equipment now used to perform the work covered by the advertisement; but the council has adjourned until Sept. 7 without action on the request.

High Bridge Movement Endorsed

Supporting the movement for the preservation of High Bridge, New York City, described last week, p. 229, the New York Chapter of the American Association of Engineers has addressed the city's Board of Estimate urging favorable consideration of plans for the preservation of the structure.

Chamber of Commerce Members Approve Twelve Principles

Approval of a platform setting up twelve principles of industrial relations has been given by the membership of the Chamber of Commerce of the United States in a referendum vote, the result of which was announced last week. The vote taken was on the report of a special committee of the Chamber's board of directors. This report went deeply into the subject of the employment relation and recommended among other things recognition of the right of open shop operation and the right of employers and employees to deal directly with each other without participation by outside interests.

At the same time the Chamber's membership in another referendum vote has approved a report of its Committee on Public Utilities recommending that strikes by public utility employees should be explicitly prohibited and that tribunals should be created by law to adjudicate in decisions binding on both parties differences between public utilities corporations and their employees.

The vote on the two referenda was the largest ever recorded by the Chamber on any subject.

The twelve principles of industrial relations advanced by the committee and the vote on each are given as follows:

1. Every person possesses the right to engage in any lawful business or occupation and to enter, individually or collectively, into any lawful contract of employment, either as employer or employee. These rights are subject to limitation only through a valid exercise of public authority.—In favor, 1,675; opposed, 2.

2. The right of open-shop operation, that is, the right of employer and employee to enter into and determine the conditions of employment relations with each other, is an essential part of the individual right of contract possessed by each of the parties.—In favor, 1,665; opposed, 4.

3. All men possess the equal right to associate voluntarily for the accomplishment of lawful purposes by lawful means. The association of men, whether of employers, employees or others, for collective action or dealing confers no authority over, and must not deny any right of, those who do not desire to act or deal with them.—In favor, 1,677; opposed, 4.

4. The public welfare, the protection of the individual, and sound employment relations require that associations or combinations of employers or employees, or both, must equally be subject to the authority of the State and legally responsible to others for their conduct and that of their agents.—In favor, 1,671; opposed, 4.

5. To develop, with due regard for the health, safety and well-being of the individual, the required output of industry is the common social obligation of all engaged therein. The restriction of productive effort or of output by either employer or employee for the purpose of creating an artificial scarcity of the product or of labor is an injury to society.—In favor, 1,675; opposed, 3.

6. The wage of labor must come out of the product of industry and must be earned and measured by its contribution thereto. In order that the worker, in his own and the general interest, may develop his full productive capacity, and may thereby earn at least a wage sufficient to sustain him upon a proper standard of living, it is the duty of management to co-operate with him to secure continuous employment suited to his abilities, to furnish incentive and opportunity for improvement, to provide proper safeguards for his health and safety and to encourage him in all practicable and reasonable ways to increase the value of his productive effort.—In favor, 1,679; opposed, 2.

7. The number of hours in the work day or week in which the maximum output, consistent with the health and well-being of the individual, can be maintained in a given industry should be ascertained by careful

study and never should be exceeded except in case of emergency, and one day of rest in seven, or its equivalent, should be provided. The reduction in working hours below such economic limit, in order to secure greater leisure for the individual, should be made only with full understanding and acceptance of the fact that it involves a commensurate loss in the earning power of the workers, a limitation and a shortage of the output of the industry and an increase in the cost of the product, with all the necessary effect of these things upon the interests of the community and the nation.—In favor, 1,677; opposed, 3.

8. Adequate means satisfactory both to the employer and his employees, and voluntarily agreed to by them, should be provided for the discussion and adjustment of employment relations and the just and prompt settlement of all disputes that arise in the course of industrial operation.—In favor, 1,668; opposed, 8.

9. When, in the establishment or adjustment of employment relations, the employer and his employees do not deal individually, but by mutual consent such dealing is conducted by either party through representatives, it is proper for the other party to ask that these representatives shall not be chosen or controlled by, or in such dealing in any degree represent, any outside group or interest in the questions at issue.—In favor, 1,568; opposed, 54.

10. The greatest measure of reward and well-being for both employer and employee and the full social value of their service must be sought in the successful conduct and full development of the particular industrial establishment in which they are associated. Intelligent and practical cooperation based upon a mutual recognition of this community of interest constitutes the true basis of sound industrial relations.—In favor, 1,664; opposed2.

11. The State is sovereign and cannot tolerate a divided allegiance on the part of its servants. While the right of government employees, national, state or municipal, to be heard and to secure consideration and just treatment must be amply safeguarded, the community welfare demands that no combination to prevent or impair the operation of government or of any government function shall be permitted.—In favor, 1,663; opposed, 4.

12. In public service activities the public interest and well-being must be the paramount and controlling consideration. The power of regulation and protection exercised by the State over the corporation should properly extend to the employees in so far as may be necessary to assure the adequate, continuous and unimpaired operation of public utility service.—In favor, 1,649; opposed, 18.

Toledo Will Pay $1.45 a Ton for Garbage Reduction

A 10-year contract for garbage disposal has been awarded by Toledo, Ohio, to the Toledo Disposal Co. The city will collect the garbage and deliver it to the existing reduction plant of the contractor, and will pay the contractor $1.45 a ton for reducing the garbage, washing each garbage can immediately after it is emptied, and maintaining about a mile of road between the public highway and the reduction plant. David H. Goodwillie is director of the Department of Public Service. S. A. Greeley, of Pearse, Greeley & Hansen, Chicago, was consulted in connection with the garbage disposal contract.

Work for North Chicago District Totals $290,000

A $290,000 budget passed by the North Shore Sanitary District includes $186,000 for a sewage disposal plant at Waukegan, $75,000 for rebuilding the plant at Highland Park, and $7,700 for experimental wells to develop water supply. John Oliver, Highland Park, Ill., is president of the district.

Notes from the Corps of Engineers

Maj. Gen. Lansing H. Beach, Chief of Engineers, is engaged on a tour of inspection which will include Detroit, Chicago, St. Paul and St. Louis. The trip between St. Paul and St. Louis will be made via the Mississippi River. He will return to Washington Aug. 10.

Col. Mason M. Patrick is paying an official visit to Fort Dodge and Camp Grant.

Lieut. Col. G. A. Youngberg is at Camp Gordon inspecting the 7th Engineers.

Maj. U. S. Grant has been ordered to San Francisco to relieve Lieut. Col. William Kelly, who has been appointed chief engineer of the Federal Power Commission.

Col. Harley B. Ferguson has been ordered to Washington to attend the General Staff College.

Col. C. W. Otwell has been assigned to the Pittsburgh district.

The following officers of the Corps of Engineers, U. S. A., have been promoted to the rank of colonel: Merriweather L. Walker, Robert R. Raymond, William B. Ladue, Wm. J. Barden, E. H. Schulz, Harry Burgess, George M. Hoffman, John C. Oakes, Sherwood A. Cheney, Fred W. Alstaetter, Harley B. Ferguson, Frank C. Boggs, Clarke S. Smith, W. P. Wooten, Lytle Brown, Earl I. Brown and Curtis W. Otwell. Major Paul S. Bond has been promoted to be a lieutenant colonel. These promotions are made by virtue of seniority under sections 24a and 24c of the Army Reorganization Act.

Urge Engineer Licensing Law in Arkansas

The Little Rock Engineers' Club took the first active step at its weekly luncheon July 24 to secure legislation governing the practice of engineering in the State of Arkansas. It will be the plan of the club, if the present project carries, to ask the next state legislature to pass a bill which will license engineers to work in the state.

Arkansas is carrying on a road-building program which calls for about 6,500 miles of hard surface road. This work is done by road districts and not by counties, as in other states. Each road district is bonded, appoints its road commissioners and they select the engineer who carries on the work.

The feeling of the Engineers' Club is that Arkansas has been imposed on by incompetent engineers. Many who lacked the knowledge or experience have had themselves appointed engineers of road districts and the state has lost and will lose thousands of dollars because of poor work and ignorance.

Its present plan is to ask the next legislature to pass a bill which will appoint an examining board. Engineers will be examined and passed in the same manner that doctors and dentists are.

Union of Technical Men Favor Flat 20 Per Cent Increase

At a meeting July 29 in New York City of a special committee of members of the Union of Technical Men representing Local No. 37 of the American Federation of Labor, the proposed flat increase of 20 per cent in salaries of New York City employees was endorsed in preference to an alternative whereby low-salaried employees would receive a larger increase at the expense of the higher paid department and division heads. The committee's resolution, sent to the Board of Aldermen and the Board of Estimate and Apportionment and signed by B. L. Schneider, president, follows:

Whereas, The Board of Estimate and Apportionment adopted a resolution to increase the salaries of the major portion of the city employees to the extent of 20 per cent of their present salaries, the Board of Aldermen concurring,

And Whereas, There has arisen objection to having the higher paid officials receive the same proportional increase in their salaries, we respectfully desire to state that in our opinion this objection is not good policy. The men in higher positions need encouragement as much as the lower paid employees so that the city may obtain their best efforts in the directing of the many great enterprises in which they are engaged and in which hundreds of millions of dollars of taxpayers' money is yearly spent. The majority of these officials have advanced to their present positions through intense study of the projects which they supervise, and deserve the highest consideration of the city. It is therefore our belief that the best interests of the city will be conserved by allowing them to have a full share in the proposed increase in salaries. During the past few years many good executives have been lost to the city when outside corporations offered them double what the city paid,

And Whereas, It has been generally agreed that the proposed 20 per cent increase will still leave the lower salaried employees unable to properly meet the continual rising cost of living,

Therefore be it Resolved, That the Union of Technical Men urge upon you to make every effort to put the proposed 20 per cent increase into effect upon Aug. 20 as agreed upon,

And be it further Resolved, That each member of the Board be requested to indicate his intention by adopting *now* a concurrent resolution requesting the department heads to include in the proposed 1921 budget an additional increase in the salaries of the lower paid employees.

The above resolution was submitted to and approved by the Committee at its meeting on July 29, 1920.

Consideration of Construction Needs Urged

(Continued from p. 284)

$4,000,000,000, and during the coming four or five years an annual average which according to present indications will exceed that total. The problems of development, finance, transportation, production and distribution of every kind involved in such a stupendous program include the most important questions of industry and government. Just at this time no other domestic problem—other than those related to the production and distribution of food and fuel—demands such careful consideration as those involved in the construction problems presented by the needs of the people.

It is in the hope that you as Chairman of the Republican National Committee will bring these facts home to the members of your organization who are at this time preparing for the discussion of the issues contained in your platform that I am addressing you. I sincerely trust that they will make clear to the great representative body of men directly interested in the construction industry as well as to all citizens, every one of whom is indirectly affected by it, the steps which they propose to take to realize the aims referred to above as set forth in their platform.

Activities of the A. A. E.

The California Chapters have just completed the formation of the California Assembly of the American Association of Engineers. It is composed of one delegate from each chapter in the state. The officers elected are: President, T. E. Stanton, Sacramento; vice-president, Burdette E. Moody, Los Angeles; secretary-treasurer, Ralph E. Dodge, San Francisco. The other delegates are: I. H. Tielman, Fresno; Arthur H. Adams, Long Beach; George S. Hinckley, Redlands; Thomas H. King, San Diego. The assembly will handle all A. A. E. matters of statewide importance or of interest to several chapters. It will also co-ordinate the work of the different state chapters and will co-operate with other technical and civic organizations in advancing matters of mutual interest.

The Executive Committee of the association has selected the following 16 railroad professional engineers to constitute its National Railroad Council: Chairman, George W. Hand, C. & N. W. Chicago; W. W. K. Sparrow, C. M. & St. P., Chicago; W. Evans, C. & A., Chicago; K. B. Lattimer, C. B. & Q.-E., Chicago; W. C. Bolin, B. & O., Chicago; F. C. Shepherd, B. & M., Boston; S. H. Brenaman, Penn., Pittsburgh; A. H. Utter, C. B. & Q.-W., Lincoln; Harold Knight, Erie, Youngstown; C. I. Long, N. Y. C.-W., Cleveland; C. C. Berritt, Southern, Washington, D. C.; Lef Winship, Mo. Pac., St. Louis; J. E. Debb, M. C., Detroit; J. T. W. Jennings, E. J. & E., Joliet; H. I. Benjamin, So. Pac., San Francisco; and F. C. Huffman, C. & N. W., Chicago.

The Montana Assembly, July 10, elected as president, William J. McMahon; secretary, C. A. Bowden, both associated with the Anaconda Copper Mining Co. of Butte.

Engineering Compensation Schedule

(Continued from p. 284)

standard rates of compensation which would be generally recognized as fair and just has long been felt by public authorities and other large employers of engineering service. We believe that this report is worthy of your very careful attention. In nearly all work on which technical engineering service is required, its cost is a very small percentage of the entire cost, so that an increase of engineers' pay to the standard scale will add a hardly noticeable amount to the total, and this in nearly all cases should be far more than offset by the economies which a higher grade of engineering service can effect.

Nor can the importance be overlooked, at this time of general industrial and social unrest, of maintaining the loyalty of professional men who should be leaders of thought and action to the organizations which they serve. This continued loyalty to professional ideals cannot be expected when men of education and intelligence receive lower pay than many unskilled laborers.

Our committee will be very glad to receive your views as to the feasibility of adopting Engineering Council's schedule of grading and compensation to the engineering and technical service employed on the work with which you have to do. We shall be glad also to furnish any information you may desire bearing on your special problems in this field.

Isham Randolph Dead

Isham Randolph, consulting engineer, of Chicago, for 14 years chief engineer of the Sanitary District of Chicago, died Aug. 2, in that city. He was born in Clarke County, Virginia, in 1848. At the age of 20 he began engineering as axeman and, later, roadman for the Winchester & Strasburg R. R., and was, successively, leveler on surveys of the Washington & Ohio R. R.; transitman on surveys for the extension of the Lehigh Valley Ry.; transitman in

ISHAM RANDOLPH

charge of locating party of the Baltimore, Pittsburgh & Chicago R.R. between Syracuse, Ind., and Chicago, later resident engineer on that work, constructing 26 miles of main line and roundhouse, shops and freight yard at South Chicago. With the Scioto Valley R. R. Co. he was assistant engineer on construction between Columbus and Chillicothe, Ohio.

From 1880 to 1885 Mr. Randolph was chief engineer of the Chicago & Western Indiana Ry. and the Belt Railway of Chicago, at the end of which period he began private practice in Chicago. The following year he became chief engineer on the construction of the Chicago, Madison & Northern Ry. and Freeport & Dodgeville Ry. for the Illinois Central R. R. In 1888 he resumed general practice in Chicago, and was consulting engineer for the Union Stock Yard & Transit Co., the Calumet Terminal Ry. and the Baltimore & Ohio R.R. From 1893 until 1907, when he resigned, he was chief engineer of the Sanitary District of Chicago. He was retained, however, as consulting engineer until the end of 1912.

In 1905, President Roosevelt appointed him on the Board of Consulting Engineers for the Panama Canal, and he was one of the five members of the board whose minority report was accepted by the President and the Secretary of War, approved by the Panama Commission and adopted by Congress. Again, in 1908, he was one of the six engineers who accompanied President-elect Taft to Panama to consider the advisability of changing the plans for the canal.

He was chairman of the Internal Improvement Commission of Illinois, which made plans for a canal from Lockport to Utica, Ill., of the State Conservation Commission, of the State Rivers and Harbors Commission and of the Chicago Harbor Commission. He made an engineering study, report and plans for a commercial harbor for Milwaukee, and was consulting engineer for Baltimore and Toronto, on track elevation work, and served as a member of the Toronto Water Supply Commission. He was also consulting engineer for the Little River Drainage District of Cape Girardeau, Mo., and reviewed the plans and estimates for the Lake Erie & Ohio River Barge Canal. He was chairman of the Florida Everglades Engineering Commission and made a complete report on the drainage of the swamp-lands of Florida. The report was accepted by the governor. He designed the harbor system for Miami, Fla. He was the designer of the Obelisk dam above the Horse Shoe Falls built for the Queen Victoria Niagara Falls Park Commission.

Mr. Randolph was past-president of the Western Society of Engineers, a member of the American Society of Civil Engineers and the American Institute of Consulting Engineers.

Water Power Commission Administration

For administrative purposes the Federal Power Commission has divided the country into five districts. District 1, which includes the most of the country east of the Mississippi River, has its headquarters in Washington. District 2, with headquarters at St. Paul, is much smaller in area and includes what may be termed the eastern Northwest. The headquarters of District 3 is St. Louis. It includes the territory directly south of District 2 to the Gulf, and in the South extends westward to the mountains. Denver is the head of District 4, which includes most of the intermountain territory, while District 5, with headquarters at San Francsico, includes the entire Pacific slope along with most of the states of Idaho, Nevada and Arizona.

The Power Commission will have its work divided under the following heads: Engineering, accounting, statistical, regulatory, licensing, legal and operation. The engineering division will be under the immediate direction of the engineer officer, who will be known as the chief engineer of the commission. For the present the accounting and statistical divisions will be operated as a unit and will be under the immediate direction of the chief accountant. The head of the legal division will be known as the chief counsel,

while the operating division will be in charge of a chief clerk.

The regulations for use in connection with the administration of the Water-Power Act are being drafted, but will not be promulgated until conferences have been held with all interests concerned.

St. Louis Limits Weight of Trucks

The City of St. Louis recently passed an ordinance regulating loads which may be carried upon the city streets. The ordinance sets a maximum limit of 28,000 lb. for truck and load, a maximum axle loading of 22,400 lb., and prescribes that the weight upon any wheel shall not exceed 800 lb. per inch width of tire. However, the director of streets and alleys is empowered to issue permits in certain instances for the movement of loads in excess of those mentioned above. Permits must prescribe the streets over which such excess loads may be carried and are limited in time to one week. Vehicles are to carry in conspicuous places certificates indicating the maximum loads they are allowed to carry, and a weight ticket, showing the weight of the vehicle and load, must be carried by the driver.

The ordinance further provides that any violation will be punishable by a fine of not less than $5 and not more than $500.

Two Concrete Ships For Sale

The United States Shipping Board announces that sealed bids will be received at the office of the chairman at Washington on or before Aug. 23 for the two reinforced-concrete tankers, "Palo Alto" and "Peralta," now under construction at the yards of the San Francisco Shipbuilding Co. at Oakland, Cal. These are the standard 7,500-ton tankers designed by the Concrete Ship Section of the Emergency Fleet Corporation.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Portland, Ore., Aug. 10-12.

AMERICAN PUBLIC HEALTH ASSOCIATION, Boston; San Francisco, Sept. 13-17.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, Valparaiso, Ind.; St. Louis, Oct. 10-15.

The Washington State Associations of County Engineers and of County Commissioners will meet in annual convention in Everett, Aug. 25-27. F. G. Tegtmeier, county engineer of Snohomish County and president of the engineers' association, will address a joint session of the engineers and commissioners on Aug. 25. James Allen, state highway commissioner, and R. H. Thomson, consulting engineer of Seattle, will be on the program. Separate sessions for the election of officers will be held on the last day of the convention.

PERSONAL NOTES

E. C. WENGER is now resident engineer on Federal Aid Road Project No. 22 in Finney County, with headquarters at Garden City, Kan.

A. W. GALBREATH has been appointed valuation engineer of the Missouri, Kansas & Texas Ry., with headquarters at Parsons, Kan.

V. B. FREDENHAGEN has been appointed resident engineer of Federal Aid Road Projects Nos. 44 and 45, with headquarters at Salina, Kan. He was formerly an assistant engineer with the Kansas State Highway Commission.

HYDE FORBES, engineer and geologist, for the past three years connected with the Lindsey-Strathmore Irrigation District of California in the investigation of underground water conditions and irrigation requirements of the Kaweah Delta for the purposes of litigation over water rights in which the district has been involved, has opened offices in Los Angeles.

STEPHEN E. PREBLE, formerly associated with I. W. Jones Co., engineers, Milton, N. H., has been elected vice-president and general manager of the Industrial Planning Corporation, Buffalo, N. Y., which company specializes in hydro-electric development and the design of pulp, paper and fiber mills.

HARLAND BARTHOLOMEW, engineer for the St. Louis City Plan Commission, has been appointed consulting engineer for the drafting of a zone law for Washington, D. C.

J. J. OCHS has been made office engineer of the Chicago & Alton R.R., with headquarters at Chicago. He succeeds J. E. Schwab, recently appointed city engineer of Alton, Ill.

L. M. NORELIUS has left the Emergency Fleet Corporation as construction engineer, at Philadelphia, for the concrete ship section on the construction of concrete barges. He is now vice-president of the Majestic Furnace & Manufacturing Co., Seattle, Wash.

GEORGE B. FORD has been appointed director of the city planning department of the Technical Advisory Corporation, New York City. Mr. Ford, who was chairman of the city planning committee of the American Institute of Architects and is a director of the American City Planning Institute, has recently been retained as adviser on foreign housing to the U. S. Senate Committee on Reconstruction and Production. Besides his city planning and zoning activities in this country, Mr. Ford has recently completed a long engagement in France, where he was city planning consultant to many of the cities of the devastated areas, including Rheims, Arras and Soissons.

FRED BROWN, erroneously referred to as city engineer of Muskegon, Mich., in the issue of this journal dated July 1, is inspector for that city on its new pumping station now under construction. R. J. Buck is city engineer.

FREDERICK GLAESER, formerly section engineer with the Board of Water Supply of the City of New York, and recently engineer for the Emergency Fleet Corporation, at Bristol, Pa., has been appointed landscape engineer and superintendent of parks of Trenton, N. J., a newly created position.

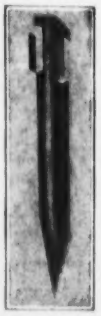
E. J. TERRILL has been appointed resident engineer on Federal Aid Road Project No. 37, with headquarters at Independence, Kan. He was formerly assistant engineer on Federal Aid Project No. 4 in Shawnee County, Kan.

OBITUARY

AUGUST HEMAN, mayor of University City, Mo., and president of the Trinidad Asphalt Co. and the Heman Construction Co., of St. Louis, died July 15, at 64 years of age. He was actively engaged in construction work in the St. Louis district and his companies handled many large building and paving contracts. During the war the Heman Construction Co. built 18 warehouses at the Rock Island Arsenal at Moline, Ill.

Support for Concrete Floor Screed

Specially made steel pins to carry screeds for concrete floors are being marketed by the Contractors Specialty Co., of St. Paul, Minn., under the name of Kingpin Screed Supports. These pressed steel pins are lightly hammered into the floor forms and carry in the upper bracket screed guides. After the concrete has taken an initial set they can be readily pulled out, leaving no serious mark in the floor, and used over again.



KING PIN SCREED SUPPORT

The accompanying illustration shows the general features of the pin.